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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor :	Steven Bathiche et al.	
Appln. No.:	09/251,519	
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For :	TWO-HANDED COMPUTER INPUT DEVICE WITH ORIENTATION SENSOR	Examiner: S. Kumar
Docket No.:	M61.12-0101	

BRIEF FOR APPELLANT

I HEREBY CERTIFY THAT THIS PAPER IS BEING SENT BY U.S. MAIL, FIRST CLASS, TO THE ASSISTANT COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231, THIS 8th DAY OF July, 2003.

Christopher L. Holbo
PATENT ATTORNEY

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Sir:

This communication is an appeal from a Final Office Action mailed on February 11, 2003, in which all of the pending claims 1-20, 22 and 23 stand finally rejected.

REAL PARTY INTEREST

Microsoft Corporation, a corporation organized under the laws of the state of Washington, and having offices at One Microsoft Way, Redmond, Washington 98052, has acquired the entire right, title and interest in and to the invention, the application, and any and all patents to be obtained therefor, as set forth in the Assignment filed with the patent application and recorded on Reel 010056, frame 0039.

RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

STATUS OF THE CLAIMS

Claims 1-20, 22 and 23 are pending in the application (see Appendix A). Claims 1-20, 22 and 23 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Hall (U.S. Pat. No. 5,838,304) in view of Willner et al. (U.S. Pat. No. 5,874,906)

Claim 21 has been cancelled. The rejection of pending claims 1-20, 22 and 23 is hereby appealed.

STATUS OF AMENDMENTS

There are no outstanding amendments.

SUMMARY OF INVENTION

The present invention generally relates to a computer input device. In particular, the present invention relates to a computer input device having an orientation sensor disposed thereon.

Various embodiments of the present invention pertain to the computer input device 14, generally described on page 5, line 27 to page 7, line 12. Fig. 1 illustrates an exemplary computer input device 14 for use with embodiments of the present invention. Input device 14 includes one or more orientation sensors arranged to sense the physical orientation of the computer input device 14 in space. Furthermore, the computer input device 14 includes rotatable wheel 24, multiple switch input device 26, shift button 28, mode switch button 30, one or more auxiliary buttons 32 and one or more triggers (Fig. 3A). The input device further includes an upper housing portion with two depending handles 17 and 19.

As schematically illustrated in Fig. 4, the computer input device 14 also includes a controller 106. Operation of controller 106 and the input device 14 is described on page 14, line 9 to page 19, line 30. Controller 106 is configured to receive signals from X and Y axis tilt sensors and circuitry 108, button array 112, zone calibration circuit 114 and wheel encoder circuit 116 through elements disposed on computer input device 14. Furthermore,

controller 106 outputs a mode indicator 118. Controller 106 also is configured to assemble data packet 122 in order to be sent to computer 20.

Various aspects of the present invention include a method of generating a data packet indicative of user operation of the computer input device 14. An exemplary data packet 122 is illustrated in Fig. 5 and described on page 19, line 31 to page 22, line 3. A related method is illustrated in Fig. 6 and includes steps described from p. 22, line 4 to page 26, line 31. Information indicative of a physical orientation of the input device is received at step 124. In addition, information indicative of a multiple switch device or a rotatable member is received at 126. Further, the orientation data and at least one of the multiple switch device information or rotatable member information is assembled into a data packet at either 134 or 146. Another aspect of the invention pertains to a data structure generated as described above.

Computer device 14 enables a number of different input modes may be used, if desired. These modes may be used to control a visual display 16. In one mode, orientation information is used to control display 16 and in another mode multiple switch information is used to control the display 16. Data packet 122 alternatively to be assembled in such a way that an application is not required to know what mode the computer input device 14 is operating in. The application can simply examine the X and Y tilt information fields and use the information accordingly. This feature saves programmers time in developing applications that utilize input device 14.

DESCRIPTION OF REFERENCES RELIED ON BY THE EXAMINER

Hall (U.S. Pat. No. 5,838,304)

Hall (see Appendix B - Exhibit A) describes a conventional mouse 7 that includes a left mouse button and a right mouse button. The mouse 7 sends a three-byte data packet whenever there is any change in the state of mouse 7. A change in state is defined as any motion of the mouse or any change in the position of the left mouse button and the right mouse button.

Willner et al. (U.S. Pat. No. 5,874,906)

Willner et al. (see Appendix A - Exhibit B) describes a data entry system 100 capable of functioning as a game controller. Data entry system 100 includes a pair of multi-directional switch assemblies 110 that provide device input signals that are output to a computer or game system.

ISSUES

Whether claims 1-20, 22 and 23 are obvious under 35 U.S.C. 103(a) over Hall in view of Willner et al.

GROUPING OF CLAIMS

The following groupings of claims are made solely in the interest of consolidating issues and expediting this Appeal. No grouping of claims is intended to be or should be interpreted as being any form of admission or a statement as to the scope or obviousness of any limitation.

Group I : Claim 1;
Group II : Claims 2, 7-9;
Group III : Claims 3-4;
Group IV : Claims 5-6;
Group V : Claim 10;
Group VI : Claim 11;

Group VII : Claim 12;
Group VIII: Claim 13, 15;
Group IX : Claim 14;
Group X : Claim 16, 18;
Group XI : Claims 17;
Group XII : Claim 19;
Group XIII: Claim 20;
Group XVI : Claim 22;
Group XV : Claim 23.

ARGUMENT

Rejection of Group I Claim

Claim 1 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Hall in view of Willner et al. Appellant submits that this combination fails to render the Group I claim obvious.

Claim 1 is an independent claim and recites a method of preparing a data packet indicative of operator manipulation of a handheld computer input device. The method includes receiving information indicative of a physical orientation of the computer input device. The method further includes receiving information indicative of a configuration of a multiple switch device located on the computer input device and having at least two different degrees of motional freedom. Movement of the multiple switch device in the different degrees of motional freedom causes actuation of different switches in the multiple switch device. Finally, the method includes placing data in an orientation field and a multiple switch field in the data packet.

1. No Prima Facie Case of Obviousness - There is no Teaching or Suggestion of All Recited Claim Limitations.

In order to establish a prima facie case of obviousness, three basic criteria must be established by the Examiner. First, there

must be some suggestion or motivation to combine the references. Next, there must be a reasonable expectation of success. Finally, the prior art references must teach or suggest all the claim limitations. See MPEP § 2143.

"It is fundamental that rejections under 35 U.S.C. 103 be based on evidence comprehended by the language of that section." In re Grasselli, 713 F.2d 731, 739, 218 USPQ 769, 775 (Fed. Cir. 1983). "The factual inquiry of whether to combine references must be thorough and searching. It must be based on objective evidence of record." In re Lee, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002). There must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant." Id. (citing In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998)). Appellant submits that the evidence of record provided in the various Office Actions is insufficient to establish an obviousness rejection. It is respectfully submitted that the rejection has been inappropriately derived based on a hindsight perspective rooted in the teachings of the application that is presently being appealed.

The latest Office Action on page two reports "it would have been obvious to one of ordinary skill in the art that the mouse of Hall could have been incorporated with multiple switches of Willner et al." In an obviousness determination, all claim limitations must be taught or suggested by the prior art. The proposed combination of these prior art references simply does not teach or suggest the claim limitation of placing data in a data packet that contains both physical orientation information and multiple switch information related to an input device having at least two degrees of motional freedom as recited in claim 1 of the present invention. The Office Action refers to Col. 2, lines 15-54 of Hall as describing the sending of a data packet whenever there is a change of state of either a left or right mouse button and a change in the motion of the mouse. This section does not

teach or suggest a data packet that contains both physical orientation information and multiple switch information related to an input device having at least two degrees of motional freedom.

The Office Action refers to col. 4, lines 20-25 of Willner et al. as describing multi-directional switch assemblies known as D-pads in a data entry system. None of these sections teach or suggest a data packet that contains both physical orientation information and a multiple switch information related to an input device having at least two degrees of motional freedom.

2. No Prima Facie Case of Obviousness - There is no Motivation or Suggestion to Combine the Cited References.

It is respectfully submitted that there is no sufficient suggestion or motivation to combine the Hall and Willner et al. references. The only statement provided for motivation to combine is on page two of the Office Action and states, "as Hall discloses in col. 1, lines 35-37 where the mouse is provided with one or more switches." This remark does not provide any evidence as to why one of ordinary skill in the art would replace the right and left mouse buttons of Hall with the multi-directional switch assemblies described by Willner et al. "Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references." Lee, 61 USPQ2d at 1433 (quoting In re Dembiczak, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999)).

A data packet containing the combination of physical orientation information and multiple switch information related to an input device having at least two degrees of motional freedom is a feature taught in the present invention. The mouse of Hall does have a right and left mouse button for selection of

program items and altering the program flow. However, Hall does not describe any motivation, suggestion or desirability for replacing the left and right mouse buttons with a multi-directional switch assembly having two degrees of motional freedom.

In addition, Willner et al. does not suggest the combination. Willner et al. merely discloses multi-directional switch assemblies, but does not mention assembling orientation information and multiple switch information into an orientation field and multiple switch field of a data packet. The Examiner does not give any indication as to why one skilled in the art would have been so motivated to conceive features that are neither taught nor suggested by either of the cited references. No specific citations are made to any of the cited references that would demonstrate a teaching or suggestion to support a finding that the claimed features are obvious. No explanation is given as to what knowledge possessed or specific principle known by a skilled artisan would lead to conception of the claimed features. No recognition is given to applicable trends in the art. No explanation is provided as to how or why one skilled in the art would be lead to the claimed invention. Thus, it appears that the motivation provided by the Examiner is not supported by the evidence of record.

3. Modifying the Push Buttons of Hall with a Multi-Directional Switch Assembly of Willner et al. Renders the Prior Art Invention Inoperable or Destroys its Intended Function.

It is respectfully submitted that the proposed combination of the Hall and Willner et al. references is suspect because the modifications necessary for the combination would cause the art to become inoperable or destroy its intended function. If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is

no suggestion or motivation to make the proposed modification. MPEP § 2143.01 (citing In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)). Specifically, combining the present references would destroy the intended function of Hall. The right and left push buttons taught by Hall are used for the selection of program items (e.g., for altering the program flow in a host computer). In accordance with Hall, the relative displacement of the mouse is determined through either mechanical or optical methods separate from the left and right push buttons. It is respectfully submitted that if the multi-directional switches of Willner were incorporated into the left and right push buttons of Hall, Hall's function of altering program flow would be lost and replaced with additional orientation ability. Hall already possesses orientation ability. Hall has no disclosed or suggested use for additional orientation ability. Thus, combining these references would lead to multiple orientation abilities for a single input device, which is undesirable, and renders the single input device inoperable for altering program flow.

Accordingly, Appellant submits that the rejection of the Group I claim is not supported by the cited references. The Examiner has failed to establish a prima facie case of obviousness. The references themselves provide no teaching of the claimed invention and no motivation to combine the references. Even if combined, the combination is inoperable for the intended function of the references. As a result, Appellant respectfully requests reversal of the rejection of the Group I claim.

Rejection of Group II Claims

Claims 2 and 7-9 relate to receiving and placing information indicative of a selected mode. In particular, claim 2 recites receiving information indicative of a selected mode of a plurality of selectable modes of operation. Claim 2 further recites placing data in the orientation field and the multiple

switch field in the data packet based on the selected mode.

The Office Action refers to col. 2, lines 14-54 of Hall as teaching the features of claim 2. In this section, Hall describes sending a data packet to a host computer that contains data related to motion of the mouse and data related to changes in position of the right and left push buttons. However, Hall does not teach receiving information indicative of a selected mode of operation and then placing data in an orientation field and a multiple switch field in a data packet based on the selected mode. Appellant notes that Hall does not describe any selection of a mode nor placing data in an orientation field or multiple switch field depending on the selected mode. Claims 7-9 depend from claim 2 and add only further limitations thereto. Accordingly, reversal of the rejection of the Group II claims is respectfully requested.

Rejection of Group III Claims

Claims 3 and 4 relate to placing data in the orientation field based on first and second selected modes. In particular, claim 3 recites placing orientation data indicative of the physical orientation of the computer device in the orientation field when the selected mode is a first selected mode. Claim 3 also recites placing predetermined orientation data in the orientation field when the selected mode is a second selected mode. The predetermined orientation data corresponds to the configuration of the multiple switch device. Thus, in one mode the orientation sensor data is used to populate the orientation field, and in the other mode the multiple switch device data is used to populate the orientation field.

The Office Action again refers to col. 2, lines 14-54 of Hall as teaching the features of claim 3. Hall describes sending a data packet to a host computer that contains data related to motion of the mouse and data related to changes in position of

the right and left push buttons. However, Hall does not teach placing orientation data indicative of physical orientation in the orientation field when the selected mode is a first selected mode, and placing predetermined orientation data in the orientation field when the selected mode is a second selected mode. Hall does not disclose any selection mode ability. Therefore, Hall does not disclose placing orientation data in the orientation field when in a first selected mode and placing predetermined orientation data in the orientation field when in a second selected mode. Accordingly, reversal of the rejection of the Group III claims is respectfully requested.

Rejection of Group IV Claims

Claims 5 and 6 also relate to placement of information in the data packet based on a selected mode. Claim 5 recites placing predetermined switch configuration data in the multiple switch field when the selected mode is the second selected mode. Claim 6 recites that the predetermined switch configuration data in the multiple switch field corresponds to depression of no switches in the multiple switch device.

The Office Action asserts that col. 2, lines 30-54 of Hall teach features of claim 5 and that col. 2, lines 14-29 teach features of claim 6. Hall describes sending a data packet to a host computer that contains data related to motion of the mouse and data related to changes in position of the right and left push buttons. However, Hall does not disclose any selection mode ability. Therefore, Hall does not disclose placing predetermined switch configuration data in the multiple switch field when the selected mode is the second selected mode.

In sum, the Examiner has not pointed to any teaching or suggestion that predetermined switch configuration data is placed in the data packet of Hall according to a second selected mode. Appellant respectfully submits that these claims are allowable.

Rejection of Group V Claim

Claim 10 also relates to placing data in the orientation field and the multiple switch field based on the selected mode. Claim 10 further recites that placing data is performed by the input device driver. Claim 10 recites that the input device receives a data packet comprising an orientation field including physical orientation information, a multiple switch field including switch information indicative of the configuration of the multiple switch device, and a mode field including mode information indicative of a selected mode. Claim 10 also recites maintaining the orientation information in the orientation field and the switch information in the multiple switch field when the selected mode is a first mode.

On page four of the Office Action, claim 10 was rejected under the same rationale as claim 1 and 3. For reasons noted above, Appellant submits that there is no teaching or motivation to provide the method as described in claim 10. The combination has various deficiencies as previously described. Accordingly, reversal of the rejection of claim 10 is respectfully requested.

Rejection of Group VI Claim

Claim 11 also relates to placing data in the orientation field and the multiple switch field in the data packet based on the selected mode by the input device driver. Claim 11 recites that the input device driver replaces the orientation information in the orientation field with a predetermined orientation value when the selected mode is a second selected mode. The predetermined orientation value is based on the switch information.

The Office Action on page four refers to col. 2, lines 30-54 of Hall as teaching features of claim 11. This section of Hall describes the format of a three byte data packet. For example, the packet includes a one (1) which indicates that either the right or left mouse button is depressed and also includes a zero (0) which

indicates that either the right or left mouse button is released. The data packet also includes relative displacement of the mouse in the X-direction as well as the Y-direction. However, Hall does not disclose any selection mode ability as well as any ability to replace the orientation information in the orientation field with switch information. Hall discloses a format of orientation data and button data, but clearly there is no teaching or suggestion of receiving orientation information and switch information indicative of the configuration of the multiple switch device. Accordingly reversal of the rejection is respectfully requested.

Rejection of Group VII Claim

Claim 12 also relates to placing data in the orientation field and the multiple switch field in the data packet based on the selected mode by the input device driver. Claim 12 recites further that the input device driver replaces the switch information in the multiple switch field with a predetermined value when the selected mode is the second selected mode.

The Office Action on page four refers to col. 2, lines 14-54 of Hall as teaching features of claim 12. In this section, Hall describes sending a data packet to a host computer that contains data related to motion of the mouse and data related to changes in position of the right and left push buttons. However, Hall does not disclose any selection mode ability, therefore, Hall does not disclose replacing switch information in the multiple switch field with a predetermined value when the selected mode is the second selected mode.

The Examiner has not pointed to any teaching or suggestion that switch information is placed in the data packet of Hall according to a second selected mode. Appellant respectfully submits that this claim is allowable.

Rejection of Group VIII Claims

In another aspect of the present invention, as set out in claims 13 and 15, a method of preparing a data packet includes receiving information indicative of a physical orientation of the computer input device. Furthermore, the method includes receiving rotation information indicative of rotation of a rotatable member on the computer input device and placing data in an orientation field and a rotation field in the data packet based on the orientation information and the rotation information. An exemplary rotatable member is shown as wheel 24 in FIG. 1.

The Examiner has rejected claim 13 on page four of the Office Action based upon the section of Willner et al. that discloses multi-directional switch assemblies 110 and 112 in col. 4, lines 20-25. This section of Willner et al. discloses multi-directional switch assemblies that are commonly known as D-pads, which are substantially planar. D-pads are user actuated by applying pressure to the surface of the D-pad. The applied pressure tilts the D-pad out of plane. Clearly, a close reading shows that the multi-directional switch assemblies of Willner et al. are not rotatable members as recited in claim 13. Accordingly, reversal of this rejection is respectfully requested.

Rejection of Group IX Claim

Claim 14 also relates to preparing a data packet by receiving orientation information indicative of physical orientation, receiving rotation information indicative of rotation of a rotatable member and placing the orientation information and rotation information in an orientation field and a rotation field. Claim 14 further recites receiving switch information indicative of a configuration of a multiple switch device.

On page four of the Office Action, claim 14 was rejected under the same rationale as claim 1 and 13. For the reasons given above, Appellant submits that there is no teaching or motivation to

prepare the data packet as recited in claim 13. The combination has various deficiencies as previously described.

In addition, neither Hall nor Willner et al. teach or suggest preparing a data packet by receiving both physical orientation and multiple switch information indicative of a configuration of a multiple switch device. Thus, claim 14 is believed to be allowable.

Rejection of Group X Claims

In yet another aspect of the present invention, claims 16 and 18 recite a data structure for transmission to a computer. The data structure includes an orientation field, which contains orientation data indicative of physical orientation of the computer input device. Furthermore, the data structure includes a switch field containing switch information indicative of a multiple switch device located on the computer input device. The multiple switch device includes at least two different degrees of motional freedom wherein movement of the multiple switch device in the different degrees of motional freedom causes actuation of different switches in the multiple switch device. An exemplary data structure is illustrated in FIG. 5.

On page three of the Office Action, claim 16 was rejected under the same rationale as claim 1. For reasons given above, Appellant submits that there is simply no teaching or motivation to provide the data structure as recited in claim 16. The combination has various deficiencies as previously described. Thus, claim 16 is believed to be independently allowable.

Rejection of Group XI Claim

Claim 17 depends from claim 16 and further recites a rotation field containing rotation information indicative of rotation of a rotatable member on the computer input device. An exemplary rotatable member is illustrated in FIG. 1.

On page four of the Office Action, claim 17 was rejected under the same rationale as claim 13. For reasons given above, Appellant submits that there is no teaching or motivation to provide a rotatable member as recited in claim 17. The combination has various deficiencies as previously described in the Group VIII claims. Accordingly, claim 17 is believed to be allowable.

Rejection of Group XII Claim

Claim 19 depends from claim 16 and further recites a mode field containing mode information indicative of a state of a mode selector on the computer input device.

On page five of the Office Action, claim 19 was rejected under the same rationale as claims 1, 3, 13 and 16. As discussed above, neither Hall nor Willner et al. teach or suggest a separate mode field. Therefore, neither Hall nor Willner et al. discloses a mode field containing mode information indicative of a mode selector. Accordingly, reversal of the rejection of the Group XII claim is respectfully requested.

Rejection of Group XIII Claim

In yet another aspect of the present invention, claim 20 recites a computer input device that includes a first housing portion including at least one user actuable input device and first and second extending handles coupled to and extending away from the first housing portion. The computer input device further includes an orientation sensor coupled to the first housing portion. The orientation sensor senses a physical orientation of the first housing portion and further provides an orientation signal indicative thereof. A controller is coupled to the orientation signal and receives the orientation signal and places data in an orientation field based on the orientation signal in a data packet. Also, a multiple switch device has at least two different degrees of motional freedom and is actuable by an operator of the input

device. Movement of the multiple switch device in different degrees of motional freedom causes actuation of different switches in the multiple switch device. The controller is further configured to receive switch information indicative of a configuration of the multiple switch device and to place switch data in a multiple switch field in the data packet based on the switch information.

On page three of the Office Action, claim 20 was rejected under the same rationale as claims 1 and 13. Appellant submits that for all of the above-discussed reasons, the combination of Hall and Willner et al. fails to teach or suggest the features of the computer input device of claim 20. As mentioned earlier, there is no teaching or suggestion to combine the multi-directional switch assemblies of Willner et al. with the conventional mouse push buttons of Hall. The combined computer input device would include two orientation devices in a conventional mouse, which is unnecessary and leaves the mouse no feature to select program information.

Furthermore, there is no teaching or suggestion to combine these features in an input device having two extending modules. Specifically, neither reference teaches or suggests an orientation sensor in an input device having first and second extending handles coupled to and extending away from a first housing portion. Accordingly, it is respectfully submitted that the rejection of claim 20 should be reversed.

Rejection of Group XIV Claim

Claim 22 depends from claim 20 and further recites a mode selector actuable by an operator. The controller is further configured to receive mode information indicative of a selected mode of a plurality of selected modes of operation. Data is placed in the orientation field and the multiple switch field based on the selected mode.

The Examiner rejected claim 22 on page five of the Office Action based upon the same rationale as used in claim 3. As previously discussed, neither Hall nor Willner et al. teach or suggest a separate mode selector and any ability to receive mode information based on a selected mode. Therefore, Appellant submits that there is simply no teaching or motivation to provide the computer input device with a mode selector as recited in claim 22. The combination of Hall and Willner et al. has various deficiencies as previously described. Thus, claim 22 is believed to be allowable.

Rejection of Group XV Claim

In a further aspect of the present invention, claim 23 recites controlling a visual display on a computer display device based on an input from a computer input device. The method includes receiving orientation information indicative of the physical orientation of the computer input device. Furthermore, switch information is received that is indicative of a configuration of a multiple switch device located on the computer input device. The multiple switch device has at least two different degrees of motional freedom and movement of the multiple switch device in the different degrees of motional freedom causes actuation of different switches in the multiple switch device. Additionally, mode information is received that is indicative of a selected mode of operation. Furthermore, the method includes controlling the display device such that an object being displayed on the visual display device assumes a visual orientation corresponding to one of the physical orientation of the computer input device as indicated by the orientation information and the configuration of the multiple switch device as indicated by the switch information. The visual orientation is based on the selected mode.

The Office Action rejects Claim 23 on page three. The Office Action relies on col. 2, lines 14-54 of Hall to teach the

features of claim 23. In this section, Hall describes sending a data packet to a host computer that contains data related to motion of the mouse and data related to changes in position of the right and left push buttons. However, Hall does not teach receiving physical orientation data, receiving switch information indicative of a configuration of a multiple switch device and receiving mode information based on a selected mode of operation. Appellant notes that Hall does not describe any selection of a mode of operation nor receiving physical orientation information and multiple switch information. Accordingly, reversal of the rejection of the Group XV claims is respectfully requested.

CONCLUSION

The cited combination of references fails to teach or suggest the features recited in the pending claims. Also, there is no motivation to combine the cited references. Furthermore, the Examiner has not established a prima facie case of obviousness based on evidence of record. As a result, claims 1-20 and 22-23 are believed to be allowable. Reversal of the rejection to all claims is respectfully requested.

Respectfully submitted,

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APPENDIX A

PENDING CLAIMS 1-20, 22 AND 23

1. A method of preparing a data packet indicative of operator manipulation of a hand held computer input device, the method comprising:

receiving information indicative of a physical orientation of the computer input device;

receiving information indicative of a configuration of a multiple-switch device located on the computer input device and having at least two different degrees of motional freedom wherein movement of the multiple-switch device in the different degrees of motional freedom causes actuation of different switches in the multiple-switch device; and

placing data in an orientation field and a multiple-switch field in the data packet.

2. The method of claim 1 and further comprising:

receiving information indicative of a selected mode of a plurality of selectable modes of operation; and

placing the data in the orientation field and the multiple-switch field in the data packet based on the selected mode.

3. The method of claim 2 wherein the step of placing the data comprises:

placing orientation data indicative of the physical orientation of the computer input device in the orientation field when the selected mode is a first selected mode; and

placing predetermined orientation data in the orientation

field when the selected mode is a second selected mode, the predetermined orientation data corresponding to the configuration of the multiple-switch device.

4. The method of claim 3 wherein placing predetermined orientation data comprises:

selecting a predetermined orientation value from a plurality of predetermined orientation values based on the configuration of the multiple-switch device.

5. The method of claim 3 wherein placing the data further comprises:

placing predetermined switch configuration data in the multiple-switch field when the selected mode is the second selected mode.

6. The method of claim 5 wherein the predetermined switch configuration data corresponds to depression of no switches in the multiple-switch device.

7. The method of claim 2 wherein the step of placing the data in the orientation field and the multiple switch field in the data packet based on the selected mode is performed on the computer input device.

8. The method of claim 2 wherein the computer input device is coupled to a computer and wherein the step of placing the data in the orientation field and the multiple switch field in the data packet based on the selected mode is performed on the computer.

9. The method of claim 8 wherein the computer includes an input device driver and wherein the step of placing the data in the orientation field and the multiple switch field in the data

packet based on the selected mode is performed on the computer by the input device driver.

10. The method of claim 1 wherein the step of placing the data in the orientation field and the multiple switch field in the data packet based on the selected mode is performed on the computer by the input device driver by:

receiving an input device data packet comprising an orientation field including orientation information indicative of the physical orientation of the computer input device, a multiple-switch field including switch information indicative of the configuration of the multiple-switch device and a mode field including mode information indicative of the selected mode; and

maintaining the orientation information in the orientation field and the switch information in the multiple-switch field when the selected mode is a first selected mode.

11. The method of claim 10 wherein the step of placing the data in the orientation field and the multiple switch field in the data packet based on the selected mode is performed on the computer by the input device driver by:

replacing the orientation information in the orientation field with a predetermined orientation value, based on the switch information, when the selected mode is a second selected mode.

12. The method of claim 11 wherein the step of placing the data in the orientation field and the multiple switch field in the data packet based on the selected mode is performed on the computer by the input device driver by:

replacing the switch information in the multiple-switch field with a predetermined value when the selected mode

is the second selected mode.

13. A method of preparing a data packet indicative of operator manipulation of a hand held computer input device, the method comprising:

receiving orientation information indicative of a physical orientation of the computer input device;

receiving rotation information indicative of rotation of a rotatable member on the computer input device; and

placing data in an orientation field and a rotation field in the data packet based on the orientation information and the rotation information.

14. The method of claim 13 and further comprising

receiving switch information indicative of a configuration of a multiple-switch device on the computer input device; and

placing data in a multiple-switch field in the data packet based on the switch information.

15. The method of claim 14 and further comprising

receiving button information indicative of depression of a plurality of buttons on the computer input device; and

placing data in a button field in the data packet based on the button information.

16. A data structure generated by a computer input device for transmission to a computer, comprising:

an orientation field containing orientation data indicative of a pitch and roll physical orientation of the computer input device; and

a switch field containing switch information indicative of a multiple-switch device located on the computer input

device and having at least two different degrees of motional freedom wherein movement of the multiple-switch device in the different degrees of motional freedom causes actuation of different switches in the multiple-switch device.

17. The data structure of claim 16 and further comprising:
a rotation field containing rotation information indicative of rotation of a rotatable member on the computer input device.

18. The data structure of claim 17 and further comprising:
a button field containing button information indicative of depression of buttons on the user input device.

19. The data structure of claim 18 and further comprising:
a mode field containing mode information indicative of a state of a mode selector on the computer input device.

20. A computer input device, comprising:
a first housing portion including at least one user actuable input device;
a first extending handle, coupled to and extending away from, the first housing portion;
a second extending handle, coupled to and extending from the first housing portion;
an orientation sensor coupled to the first housing portion and sensing a physical orientation of the first housing portion and providing an orientation signal indicative thereof;
a controller coupled to the orientation sensor and configured to receive the orientation signal and place data in an orientation field, based on the orientation

signal, in a data packet;

a multiple-switch device having at least two different degrees of motional freedom and actuable by an operator such that movement of the multiple switch device in the different degrees of motional freedom causes actuation of different switches in the multiple-switch device, the controller being configured to receive switch information indicative of a configuration of the multiple-switch device and to place switch data in a multiple-switch field in the data packet based on the switch information.

22. The computer input device of claim 20 and further comprising:

a mode selector, actuable by an operator, the controller being configured to receive mode information indicative of a selected mode of a plurality of selectable modes of operation and to place the data in the orientation field and the multiple-switch field in the data packet based on the selected mode.

23. A method of controlling a visual display on a computer display device based on an input from a computer input device, the method comprising:

receiving orientation information indicative of a physical orientation of the computer input device;

receiving switch information indicative of a configuration of a multiple-switch device located on the computer input device and having at least two different degrees of motional freedom wherein movement of the multiple-switch device in the different degrees of motional freedom causes actuation of different switches in the

multiple-switch device;

receiving mode information indicative of a selected mode of operation; and

controlling the display device such that an object being displayed on the visual display device assumes a visual orientation corresponding to one of, the physical orientation of the computer input device as indicated by the orientation information and the configuration of the multiple-switch device as indicated by the switch information, based on the selected mode.

APPENDIX B

REFERENCES CITED BY EXAMINER

EXHIBIT A: Hall (U.S. Patent No. 5,838,304)

EXHIBIT B: Wilner et al. (U.S. Patent No. 5,874,906)

US005838304A

United States Patent [19]

Hall

[11] Patent Number: 5,838,304

[45] Date of Patent: Nov. 17, 1998

[54] **PACKET-BASED MOUSE DATA PROTOCOL**

[75] Inventor: **John C. Hall**, Redmond, Wash.

[73] Assignee: **Microsoft Corporation**, Redmond, Wash.

[21] Appl. No.: **947,044**

[22] Filed: **Oct. 8, 1997**

Related U.S. Application Data

[60] Continuation of Ser. No. 825,652, Jan. 23, 1992, which is a division of Ser. No. 626,393, Dec. 10, 1990, Pat. No. 5,125,077, which is a continuation of Ser. No. 568,057, Aug. 16, 1990, abandoned, which is a continuation of Ser. No. 371,529, Jun. 26, 1989, abandoned, which is a division of Ser. No. 119,314, Nov. 9, 1987, Pat. No. 4,866,602, which is a continuation of Ser. No. 548,122, Nov. 2, 1983, abandoned.

[51] **Int. Cl.**[6] **G06F 3/033**

[52] **U.S. Cl.** **345/157**; 345/163; 340/825.21; 395/821

[58] **Field of Search** 340/825.44, 825.2, 340/825.21; 345/145, 157, 163; 395/821, 850

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,613,090	10/1971	Mason	342/29
3,625,083	12/1971	Bose	345/167
3,643,148	2/1972	Brown et al.	318/628
3,732,557	5/1973	Evans et al.	345/179
3,739,347	6/1973	Forsberg	345/162
3,789,218	1/1974	Blount	250/231.13
3,852,721	12/1974	Tucker et al.	345/182
3,911,419	10/1975	Bates et al.	345/162
4,272,758	6/1981	Giraud	340/310.02
4,292,474	9/1981	Morrell et al.	379/157
4,298,957	11/1981	Duvall et al.	707/522
4,303,914	12/1981	Page	345/179
4,370,648	1/1983	Wagner et al.	340/825.2
4,375,103	2/1983	Arneth et al.	375/358
4,390,873	6/1983	Kirsch	345/166
4,390,967	6/1983	Eglowstein et al.	395/281
4,514,726	4/1985	Whetstone et al.	345/163
4,518,961	5/1985	Davis et al.	340/825.44
5,125,077	6/1992	Hall	395/821

FOREIGN PATENT DOCUMENTS

56-104561	8/1981	Japan .

OTHER PUBLICATIONS

"Mouse P-4 Interactive Graphic Input Device" Le Lieu, Switzerland, Feb. 23, 1982.

Vincent Biancomano, "Personal Computer Keyboards" Electronic Design. Sep. 29, 1983.

Fields, "Mouse Tracks Path By Electronics Only," Electronics. Oct. 20, 1982, pp. 48–49.

Primary Examiner—Thomas G. Black

Assistant Examiner—Jack M. Choules

Attorney, Agent, or Firm—Klarquist Sparkman Campbell Leigh & Whinston, LLP

[57] **ABSTRACT**

Data is transmitted from a mouse to a host computer in accordance with a 3-byte packet protocol. The first byte includes bits indicating the status of first and second buttons on the mouse. The first bit of each byte serves as a sync bit. The sync bit has a value of "1" in the first byte and a value of "0" in each of the second and third bytes. Data representing movement of the mouse in two dimensions is encoded as two 8-bit twos-complement integers which are transmitted as part of the three-byte packet.

29 Claims, 2 Drawing Sheets

	B6	B5	B4	B3	B2	B1	B0
Byte 1	1	LEFT	RIGHT	Y7	Y6	X7	X6
Byte 2	0	X5	X4	X3	X2	X1	X0
Byte 3	0	Y5	Y4	Y3	Y2	Y1	Y0

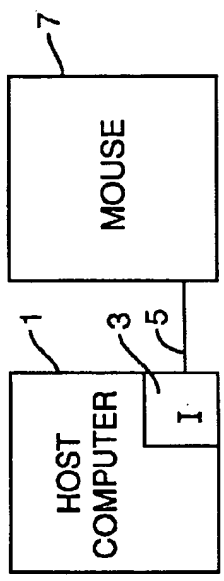

HOST COMPUTER
MOUSE
1
3
5
7

FIG. 1

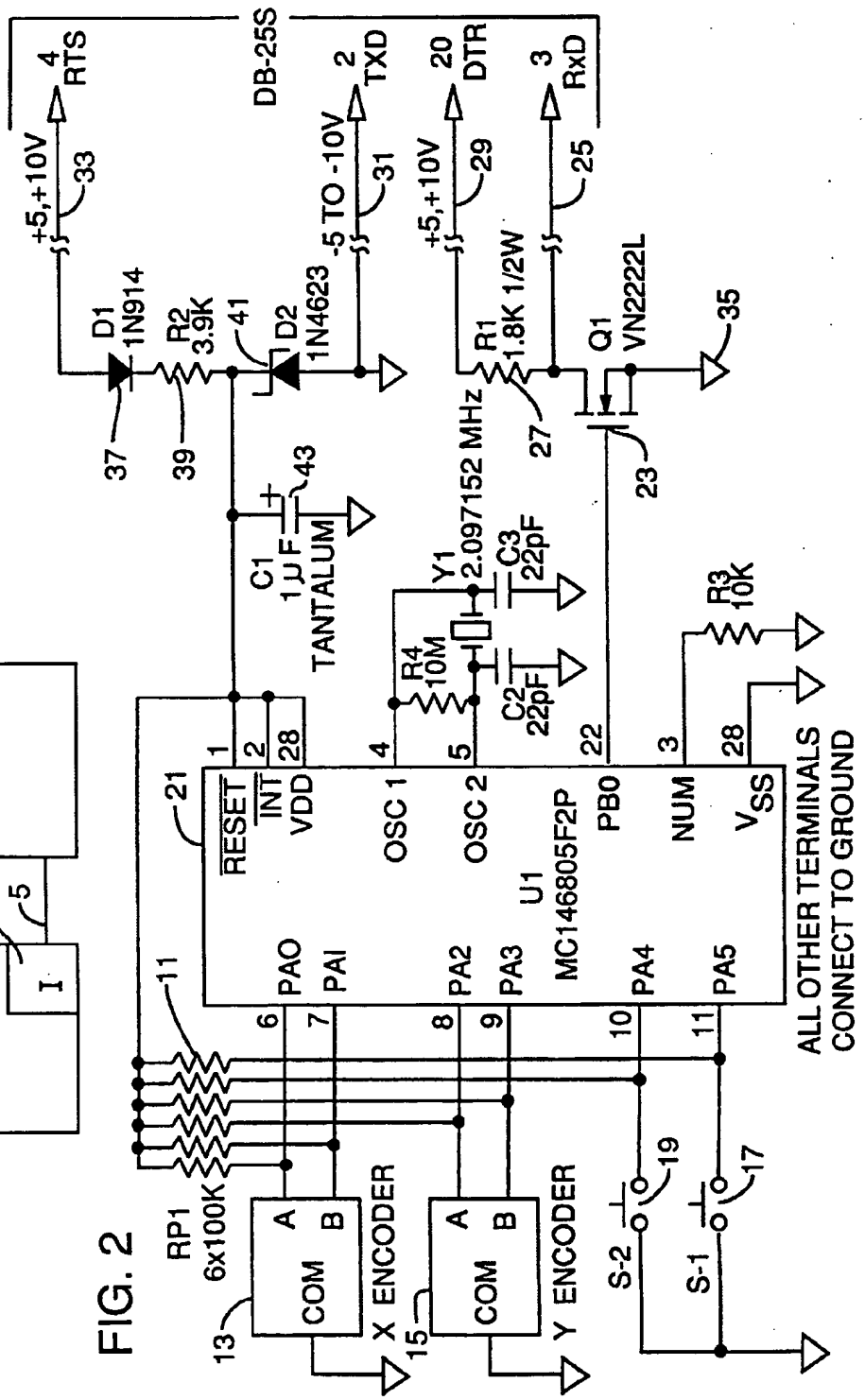

DB-25S
4 RTS
2 TXD
20 DTR
3 RxD
+5,+10V
-5 TO -10V
+5,+10V
33
31
29
25
D1 1N914
R2 3.9K
41
D2 1N4623
R1 1.8K 1/2W
Q1 VN2222L
35
37
39
27
23
C1 1µF TANTALUM
43
Y1 2.097152 MHz
C3 22pF
C2 22pF
R4 10M
R3 10K
RESET
INT
VDD
OSC 1
OSC 2
PB0
NUM
VSS
U1 MC146805F2P
PA0
PA1
PA2
PA3
PA4
PA5
21
1
2
28
4
5
22
3
28
11
6
7
8
9
10
11
RP1 6x100K
A
B
COM
X ENCODER
Y ENCODER
13
15
19
17
S-2
S-1
ALL OTHER TERMINALS CONNECT TO GROUND

FIG. 2

FIG. 3

	B6	B5	B4	B3	B2	B1	B0
Byte 1	1	LEFT	RIGHT	Y7	Y6	X7	X6
Byte 2	0	X5	X4	X3	X2	X1	X0
Byte 3	0	Y5	Y4	Y3	Y2	Y1	Y0

PACKET-BASED MOUSE DATA PROTOCOL

This application is a continuation of Application Ser. No. 07/825,652, filed on Jan. 23, 1992, which is a division of application Ser. No. 07/626,393, filed Dec. 10, 1990, now U.S. Pat. No. 5,125,077, issued Jun. 23, 1992, which is a continuation of Ser. No. 07/568,057, filed Aug. 16, 1990, now abandoned, which is a continuation of Ser. No. 07/371,529, filed Jun. 26, 1989, now abandoned, which is a division of Ser. No. 07/119,314, filed Nov. 9, 1987, now U.S. Pat. No. 4,866,602, which is a continuation of Ser. No. 06/548,122, filed Nov. 2, 1983, now abandoned. The disclosure of U.S. Pat. No. 5,125,077 is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a computer graphic input device known as a mouse and, more specifically, to a packet-based protocol for transmitting data from a mouse to a computer.

2. Description of the Prior Art

A mouse is a computer input device typically used for positioning a cursor on a computer video display screen. A typical physical embodiment of a mouse includes a small enclosure containing X-Y motion sensors, one or more push buttons operable externally of the enclosure, electrical interface circuitry, and a cable to connect the circuitry to a host computer. In operation, when the mouse is moved on a flat surface by a user, the motion sensors in the mouse detect the movement and direction of the mouse in the X-Y plane. The interface circuitry, typically within the mouse, converts the motion data produced by the sensors into a digital form usable by the host computer. Software in the host computer then utilizes the motion data to perform a particular function, for example, repositioning of the cursor on the display screen. The mouse also usually is provided with one or more switches, often in the form of push buttons, to enable alteration of the program flow in the host computer.

Mice of the above described type are normally classified by the manner in which motion is detected, the principal motion detection methods being mechanical and optical. Mechanical mice usually employ a technique whereby a spherical ball protrudes slightly below the bottom of the mouse enclosure which is free to roll as the mouse is moved by the operator along a flat surface. Inside the enclosure, the rotating ball is coupled to a pair of orthogonally mounted shaft position encoders by small rubber wheels or the like. Mouse motion is thereby converted into two pairs of quadrature signals, one pair for each axis of motion, thereby providing the required direction and displacement information corresponding to mouse movement. Optical mice utilize a method whereby a light source in the base of the mouse is reflected onto one or more photodetectors by a specially patterned surface over which the mouse is moved. Typically, a single chip computer translates the changes in detected luminance into direction and displacement signals which are utilized by the host computer in the manner described above.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing a host computer with a mouse connected to a serial interface which is a part of the host computer; and

FIG. **2** is a schematic diagram of a serial mouse in accordance with the present invention.

FIG. **3** is a drawing showing the arrangement of bits within a 3-byte packet according to a preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** is a block diagram of a host computer **1** with an interface **3** which is connected by a cable **5** to a mouse **7**. The host computer **1** includes a display device, usually a cathode ray tube, which is controlled by signals transmitted from the mouse through the cable **5** and the unmodified interface **3** to the host computer **1**. The mouse **7** receives power for its operation via the unmodified interface **3** and along certain standard signal wires of the cable **5**. In the preferred embodiment these signals are transmitted in accordance with the format defined by EIA Standard RS-232C.

In operation, in the preferred embodiment, the serial mouse sends a three-byte data package to the host computer whenever there is any change in the state of the mouse. A change of state is defined as any motion of the mouse or any change in the position of either of its buttons. The data packet sent to the host computer is an accumulation of all mouse activity that has occurred since transmission of the previous data packet. In other words, any mouse activity that occurs during the transmission of one data packet or thereafter will be accumulated for transmission in the succeeding data packet. This buffering technique allows the serial mouse to continuously track high mouse velocities while transmitting serially at a low baud rate, for example, 1200 baud. In the preferred embodiment each data packet sent by the mouse comprises three bytes. The format for each byte is:

	B6	B5	B4	B3	B2	B1	B0
Byte 1	1	LEFT	RIGHT	Y7	Y6	X7	X6
Byte 2	0	X5	X4	X3	X2	X1	X0
Byte 3	0	Y5	Y4	Y3	Y2	Y1	Y0

Bit **6** (B6) is a sync bit, set for byte **1** of a data packet, reset otherwise.

LEFT represents the state of the left mouse button; a one (1) indicates the button is down (depressed), a zero (0) indicates that the button is up (released).

RIGHT represents the state of the right mouse button in the same manner as the left button.

X0–X7 is a signed, two's complement integer that represents the relative displacement of the mouse in the X-coordinate direction since the last data transmission. A positive value indicates mouse movement to the right, negative values indicate motion to the left.

Y0–Y7 is a signed, two's complement integer that represents the relative displacement of the mouse in the Y-coordinate direction since the last data transmission. A positive value indicates mouse movement downwards, negative values indicate motion upwards.

This arrangement of bits is also shown in FIG. **3**.

FIG. **2** is a schematic drawing of the circuit of a serial mouse **7**. The circuitry may be disposed either in the mouse housing, at the host computer **1** connected to the interface **3**, or divided between the two, as desired. The mouse **7** includes an X shaft encoder **13**, a Y shaft encoder **15**, a pair of switches **17** and **19** and resistors **11** connected between a source of voltage (explained below) and each of the output terminals of the encoders **13** and **15** and the switches **17, 19**. Although two switches are shown, the number of switches provided is arbitrary, but generally is a relatively small number to simplify operation of the mouse. The output terminals from each of the encoders **13, 15** and switches **17,**

19 are connected to I/O ports PA0 to PA5 respectively of a microcomputer 21. The encoders and switches are also connected to a local ground. As explained below this local ground is different from the host computer ground. At least the encoders 13, 15, and the switches 17, 19, will be located in the mouse enclosure. All or part of the remaining circuitry can be located within the mouse enclosure, or at the host computer, connected to the mouse by a cable. The encoders 13, 15 are standard shaft encoders of a type that can be purchased from ALPS Electric or from other sources.

Microcomputer 21 is preferably an 8 bit CMOS Motorola MC 146805F2, as described in Motorola publication ADI-879, copyright 1982 by Motorola, Inc. The microcomputer is configured as specified in the above publication with the ROM of the microcomputer being configured according to the source code of the attached Appendix. The code shown in the Appendix, when loaded into the ROM, allows the microcomputer to understand the meaning of a high or low signal on any particular input line and to generate the digital code transmitted from the mouse to the host computer. Power to drive the microcomputer 21 is applied to terminal VDD which receives a positive voltage of about 4.3 volts with respect to VSS. VSS is the local ground, a voltage in the −5 to −10 volt range relative to the host computer ground. The clock rate of the microcomputer is determined by the crystal controlled circuit connected across the microcomputer OSC inputs, about 2.1 MHz in the preferred embodiment.

The host computer is programmed to normally place a voltage of plus 5 to 10 volts in the Request To Send (RTS) line 33 and the Data Terminal Ready (DTR) line 29 and a voltage of minus 5 to 10 volts on the Transmit Data (TXD) line 31. The Receive Data (RXD) line 25 transmits signals from the microcomputer 21 serially to the host computer 1 via the interface 3. This is accomplished by controlling the gate of transistor 23 via signals from the output PB0 of the microcomputer. The voltage on line 25 will be effectively local ground (−5 to −10 volts with respect to host computer ground) if the transistor is conducting, or the voltage on line 29 (+5 to +10 volts with respect to host ground) if the transistor is not conducting. All ground terminals in the drawing are local ground. Thus the microcomputer ground VSS takes the voltage on line 31 which is a negative voltage relative to the host computer ground. This arrangement eliminates the necessity of an additional transistor for voltage referencing between the microcomputer and the host computer. All signals on lines 29, 31 and 33 are bipolar relative to the host computer ground.

In actual operation, under programmed control of the host computer, RTS line 33 will always be at a positive voltage, TXD line 31 will always be at a negative voltage, and DTR line 29 will always be at a positive voltage. The voltages on lines 29, 31 and 33 are utilized in accordance with the present invention as a power source to provide power to the microcomputer 21 across VDD and VSS and to the transistor 23. Diode 37 is provided to prevent the supply voltage to the microcomputer 21 from becoming negative at VDD with respect to local ground. Resistor 39 is a current limiting resistor and Zener diode 41 establishes a voltage reference for the microcomputer 21. The capacitor 43 is a filter capacitor to remove ripple components.

Although the invention has been described with respect to a specific preferred embodiment thereof, variations and modifications will be apparent to those skilled in the art. It is therefore the intention that the appended claims be interpreted as broadly as possible in view of the prior art to include all such variations and modifications.

I claim:

1. In a method of operating a cursor control device having plural buttons, at least one position sensor, and circuitry for encoding data from said buttons and sensor into plural byte packets for transmission to an associated computer, an improvement comprising formatting each byte of the packet to include plural data bits, with a sync bit at an end thereof, the sync bit in the first byte having a value of "1" and the sync bit in succeeding bytes having a value of "0," wherein the first byte of the packet can be unambiguously distinguished from later bytes of the packet.

2. The method of claim 1 which includes transmitting said bytes to the computer using an RS-232 interface, said RS-232 interface providing start and stop bits permitting identification of the beginning of each byte.

3. The method of claim 1 which includes generating an 8-bit, signed two's complement representation of relative displacement in the X-direction comprising bits X7, X6, X5, X4, X3, X2, X1, and X0, and generating an 8-bit, signed two's complement representation of relative displacement in the Y-direction comprising bits Y7, Y6, Y5, Y4, Y3, Y2, Y1 and Y0, and in which the method further includes:

formatting the first byte to include successive bits X6, X7, Y6, Y7 in sequence;

formatting the second byte to include successive bits X0–X5 in sequence; and

formatting the third byte to include successive bits Y0–Y5 in sequence.

4. The method of claim 1 which includes formatting each byte of the packet to include exactly six data bits.

5. The method of claim 1 which further includes:

coupling the cursor control device to the computer using a plural line RS-232 interface;

under control of a software driver in the computer, maintaining a first RS-232 line at a first voltage; and

from a voltage potential between said first RS-232 line and a second RS-232 line, deriving an operating voltage to power circuitry within the cursor control device.

6. The method of claim 5 in which the circuitry includes a microcomputer, and the method includes powering the microcomputer from said operating voltage.

7. The method of claim 5 in which the circuitry includes a switching transistor for providing a data signal to the computer on a RXD line of said RS-232 interface, and the method includes powering said switching transistor from said operating voltage.

8. The method of claim 5 in which the second RS-232 line establishes a ground potential for the cursor control device.

9. The method of claim 5 in which one of said first or second lines is an RTS line.

10. The method of claim 5 in which one of said first or second lines is a TXD line.

11. The method of claim 5 in which one of said first or second lines is a DTR line.

12. In a method of operating a cursor control device having plural buttons, at least one position sensor, and circuitry for encoding data from said buttons and sensor into plural byte packets for transmission to an associated computer, an improvement comprising generating an 8-bit, signed two's complement representation of relative displacement in the X-direction comprising bits X7, X6, X5, X4, X3, X2, X1, and X0, and generating an 8-bit, signed two's complement representation of relative displacement in the Y-direction comprising bits Y7, Y6, Y5, Y4, Y3, Y2, Y1 and Y0, and in which the method further includes:

formatting the first byte to include successive bits X6, X7, Y6, and Y7 in sequence;

formatting the second byte to include successive bits X0–X5 in sequence; and

formatting the third byte to include successive bits Y0–Y5 in sequence wherein the 8 bit representation of the relative displacement fits into a byte of less than 8 bits reducing the overall number of bits transmitted by the cursor control device.

13. A cursor control device comprising:

plural buttons;

first means for providing data relating to relative position;

second means for encoding data from said buttons and said first means into plural byte packets for transmission to an associated computer, each byte consisting of seven bits B0–B6, said second means formatting the first three bytes of the packet as follows:

	B6	B5	B4	B3	B2	B1	B0
Byte 1	1	Left	Right	Y7	Y6	X7	X6
Byte 2	0	X5	X4	X3	X2	X1	X0
Byte 3	0	Y5	Y4	Y3	Y2	Y1	Y0

where Left is a bit corresponding to a state of a left cursor control button, Right is a bit corresponding to a state of a right cursor control device button, Y0–Y7 is an ordered sequence of bits representing, in signed two's complement from, a displacement in the Y-direction, and X0–X7 is an ordered sequence of 8 bits representing, in signed two's complement form, a displacement in the X-direction wherein the first byte of the packet can be unambiguously distinguished from later bytes of the packet.

14. The cursor control device of claim 13 further comprising third means for deriving an operating voltage for the device from RS-232 lines coupling the device to the computer, said third means cooperating with fourth means in the computer for setting said RS-232 lines to preestablished signal levels.

15. In a cursor device having plural buttons, at least one position sensor, and formatting circuitry for encoding data from said buttons and sensor into plural byte packets for transmission to an associated computer, an improvement wherein said formatting circuitry formats each byte of the packet to include plural data bits, with a sync bit at an end thereof, the sync bit in the first byte having a value of "1" and the sync bit in succeeding bytes having a value of "0," wherein the first byte of the packet can be unambiguously distinguished from later bytes of the packet.

16. The cursor control device of claim 15 in which the formatting circuitry generates an 8-bit, signed two's complement representation of relative displacement in the X-direction comprising bits X7, X6, X5, X4, X3, X2, X1, and X0, and generates an 8-bit, signed two's complement representation of relative displacement in the Y-direction comprising bits Y7, Y6, Y5, Y4, Y3, Y2, Y1 and Y0, and in which the formatting circuitry:

formats the first byte to include successive bits X6, X7, Y6, Y7 in sequence;

formats the second byte to include successive bits X0–X5 in sequence; and

formats the third byte to include successive bits Y0–Y5 in sequence.

17. The cursor control device of claim 15 in which the formatting circuitry formats each byte of the packet to include exactly six data bits.

18. The cursor control device of claim 15 which further comprises:

a plural line RS-232 interface for coupling to the computer;

circuitry for deriving an operating voltage to power circuitry in the cursor control device from a difference in voltage potential between first and second of said RS-232 lines.

19. The cursor control device of claim 18 in which the circuitry powered by the operating voltage includes a microcomputer.

20. The cursor control device of claim 18 in which the circuitry for deriving an operating voltage includes a zener diode.

21. The cursor control device of claim 18 in which the circuitry powered by the operating voltage includes a switching transistor that provides a data signal to the computer on a RXD line of said RS-232 interface.

22. The cursor control device of claim 18 in which the circuitry for deriving an operating voltage includes a resistor.

23. The cursor control device of claim 18 in which the second RS-232 line establishes a ground potential for the cursor control device.

24. The cursor control device of claim 18 in which one of said first or second lines is an RTS line.

25. The cursor control device of claim 18 in which one of said first or second lines is a TXD line.

26. The cursor control device of claim 18 in which one of said first or second lines is a DTR line.

27. The cursor control device of claim 15 including exactly two buttons.

28. The cursor control device of claim 15 in which each packet consists of exactly three bytes.

29. The cursor control device of claim 15 in which the formatting circuitry comprises a microcomputer.

* * * * *

US005874906A

United States Patent [19]

Willner et al.

[11] Patent Number: 5,874,906

[45] Date of Patent: Feb. 23, 1999

[54] **DATA ENTRY SYSTEM**

[75] Inventors: **Michael A. Willner**, Mason Neck, Va.; **Scott M. Arnel**, Syosset, N.Y.

[73] Assignee: **Wilnel, Inc.**, Mason Neck, Va.

[21] Appl. No.: **934,648**

[22] Filed: **Sep. 22, 1997**

[51] **Int. Cl.**[6] **H03K 17/94**

[52] **U.S. Cl.** **341/22**; 341/26; 345/161; 345/160; 345/168; 463/36; 463/37; 463/38

[58] **Field of Search** 341/20, 22; 400/485, 400/489, 100; 345/160, 168, 161; 463/38, 36, 37

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,990,565	11/1976	Felton et al.	400/70
4,360,892	11/1982	Endfield	707/534
4,442,506	4/1984	Endfield	341/22
4,443,789	4/1984	Endfield et al.	341/22
4,516,939	5/1985	Crimmins, Jr.	434/38
4,518,164	5/1985	Hayford, Jr.	273/148 B
4,552,360	11/1985	Bromley et al.	463/38
4,655,621	4/1987	Holden	400/100
4,680,577	7/1987	Strayer et al.	345/160
4,727,478	2/1988	Endfield et al.	395/887
4,833,446	5/1989	Eilam et al.	341/22
4,917,516	4/1990	Retter	400/489
5,137,384	8/1992	Spencer et al.	400/489
5,160,919	11/1992	Mohler et al.	345/168
5,207,426	5/1993	Inove et al.	463/36
5,317,505	5/1994	Karabed et al.	463/37
5,332,322	7/1994	Gambaro	400/489
5,408,621	4/1995	Ben-Arie	364/190
5,426,449	6/1995	Danziger	345/168
5,432,510	7/1995	Matthews	341/20
5,451,053	9/1995	Garrido	463/38
5,479,163	12/1995	Samulewicz	121995/341
5,481,263	1/1996	Choi	341/20
5,486,058	1/1996	Allen	400/485
5,493,654	2/1996	Gopher et al.	341/22

FOREIGN PATENT DOCUMENTS

213022	4/1987	European Pat. Off. .
308048	9/1918	Germany .
WO 86/05143	12/1986	WIPO .

OTHER PUBLICATIONS

P. J. Kennedy, "Hand-Held Data Input Device," IBM Technical Disclosure Bulletin, vol. 26, No. 11, Apr. 1984, pp. 5826-5827.

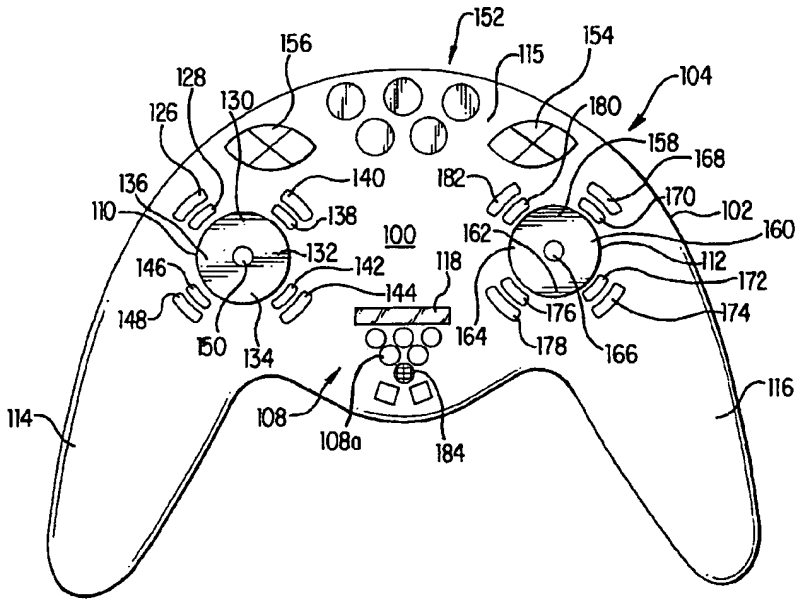
D. C. Kowalski, "Semi-Captive Keyboard," Xerox Disclosure Journal, vol. 1, No. 2, Feb. 1976, p. 85.

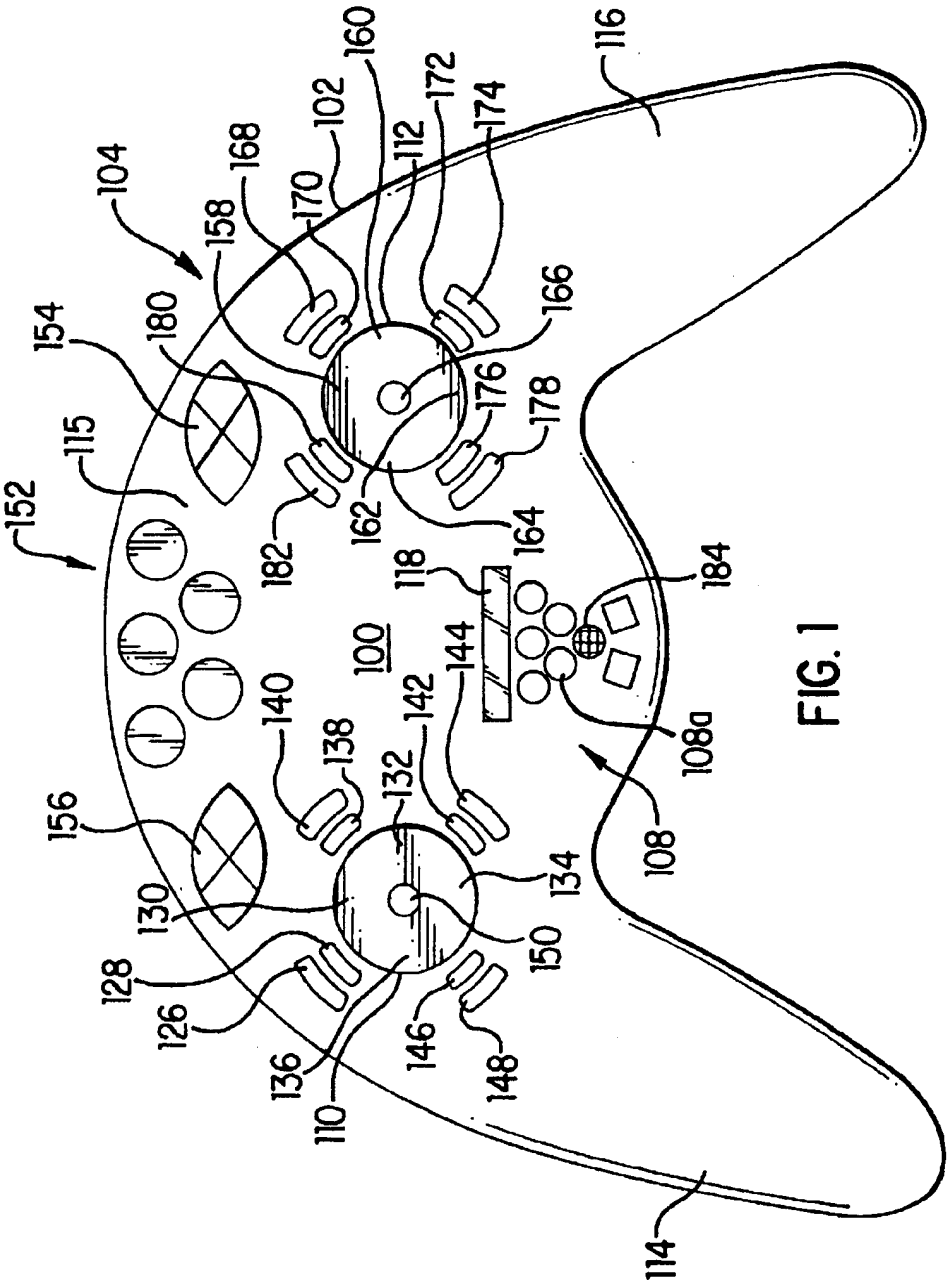
Primary Examiner—Michael Horabik
Assistant Examiner—Albert K. Wong
Attorney, Agent, or Firm—Rosenberg, Klein & Bilker

[57] **ABSTRACT**

A data entry system (**100, 100'**) has an ergonomic base (**102, 102'**) including upper surface controls (**104, 104'**) which generate a first set of electrical signals, and side surface controls (**106, 106'**) which generate a second set of electrical signals when operated independently. A third set of electrical signals are generated when the side surface controls (**106, 106'**) are operated in combination with the upper surface controls (**104, 104'**). Data entry system (**100, 100'**) further includes mode selection controls (**108**) for establishing the first, second and third sets of electrical signals as device control signals responsive to a first mode being selected and respective sets of alphanumeric and keyboard control signals responsive to a second mode being selected.

15 Claims, 7 Drawing Sheets

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134
130
150
128
126
146
148
136
110
114

FIG. 1

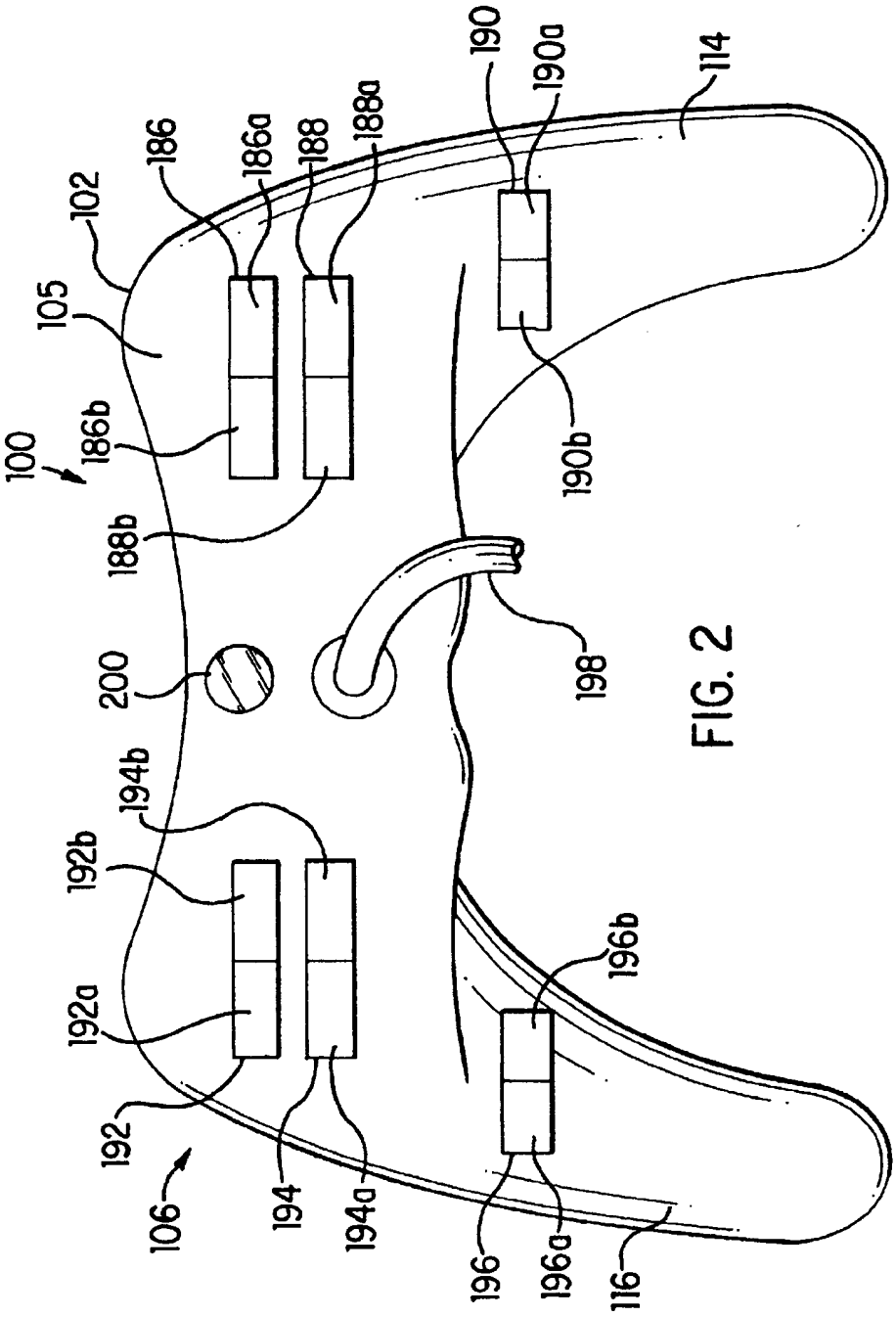
100
102
105
106
114
116
186
186a
186b
188
188a
188b
190
190a
190b
192
192a
192b
194
194a
194b
196
196a
196b
198
200

FIG. 2

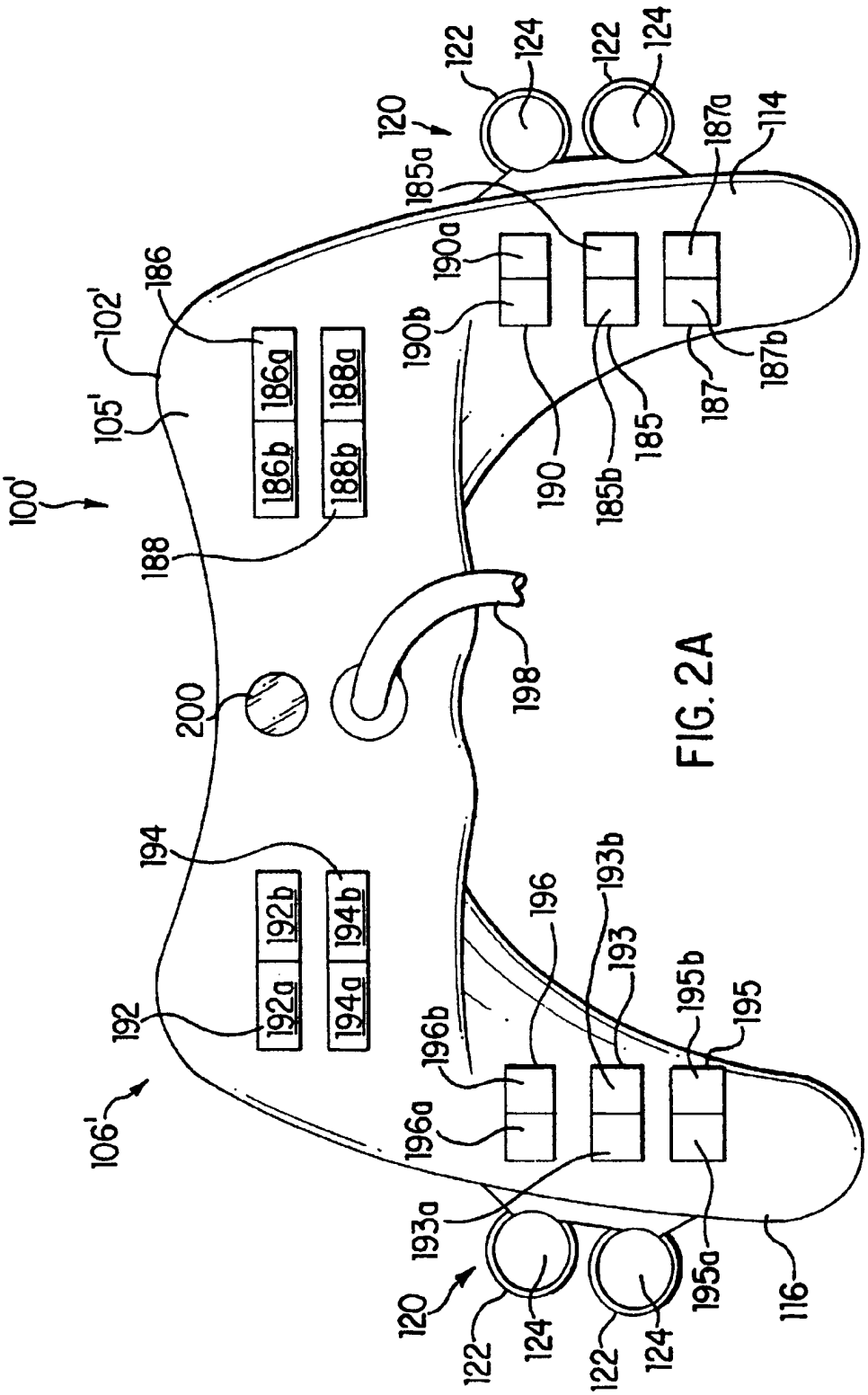
100'
102'
105'
106'
114
116
120
122
124
185
185a
185b
186
186a
186b
187
187a
187b
188
188a
188b
190
190a
190b
192
192a
192b
193
193a
193b
194
194a
194b
195
195a
195b
196
196a
196b
198
200

FIG. 2A

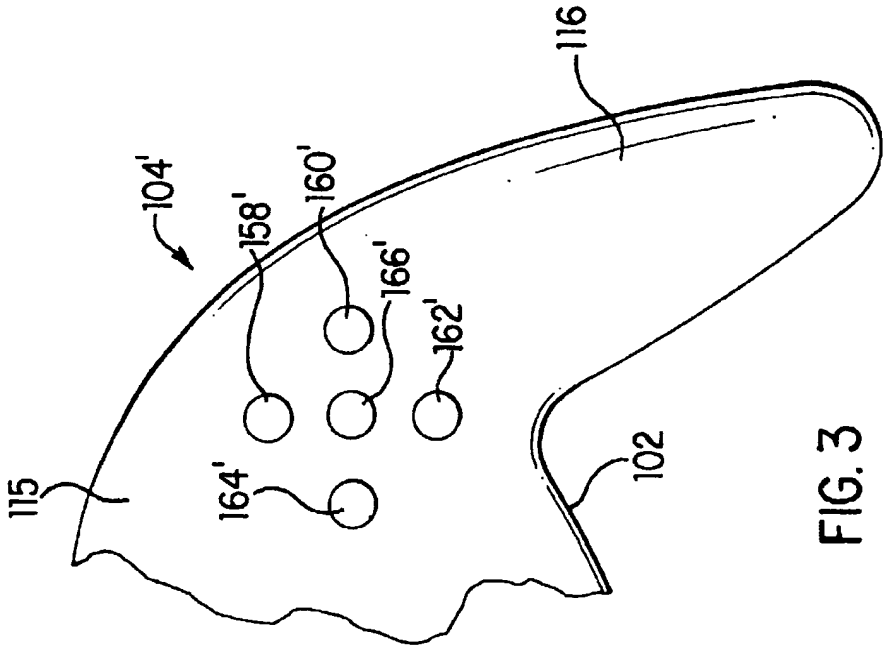

FIG. 3

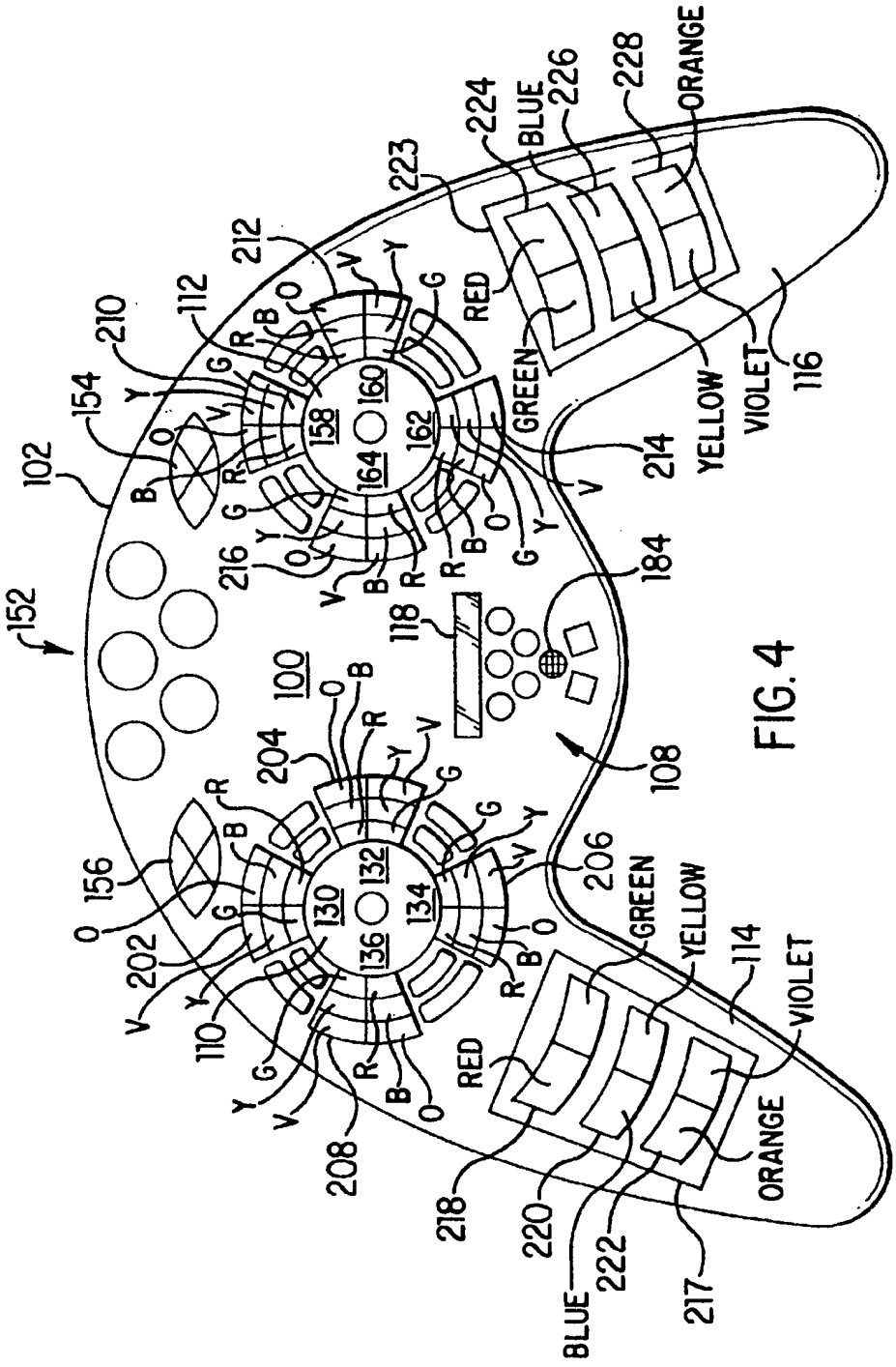
152
102
154
210
112
212
223
224
BLUE
226
228
ORANGE
RED
GREEN
YELLOW
VIOLET
116
214
216
184
118
100
204
108
206
156
202
110
208
218
220
222
217
114
130
132
134
136
158
160
162
164
R
O
Y
G
B
V

FIG. 4

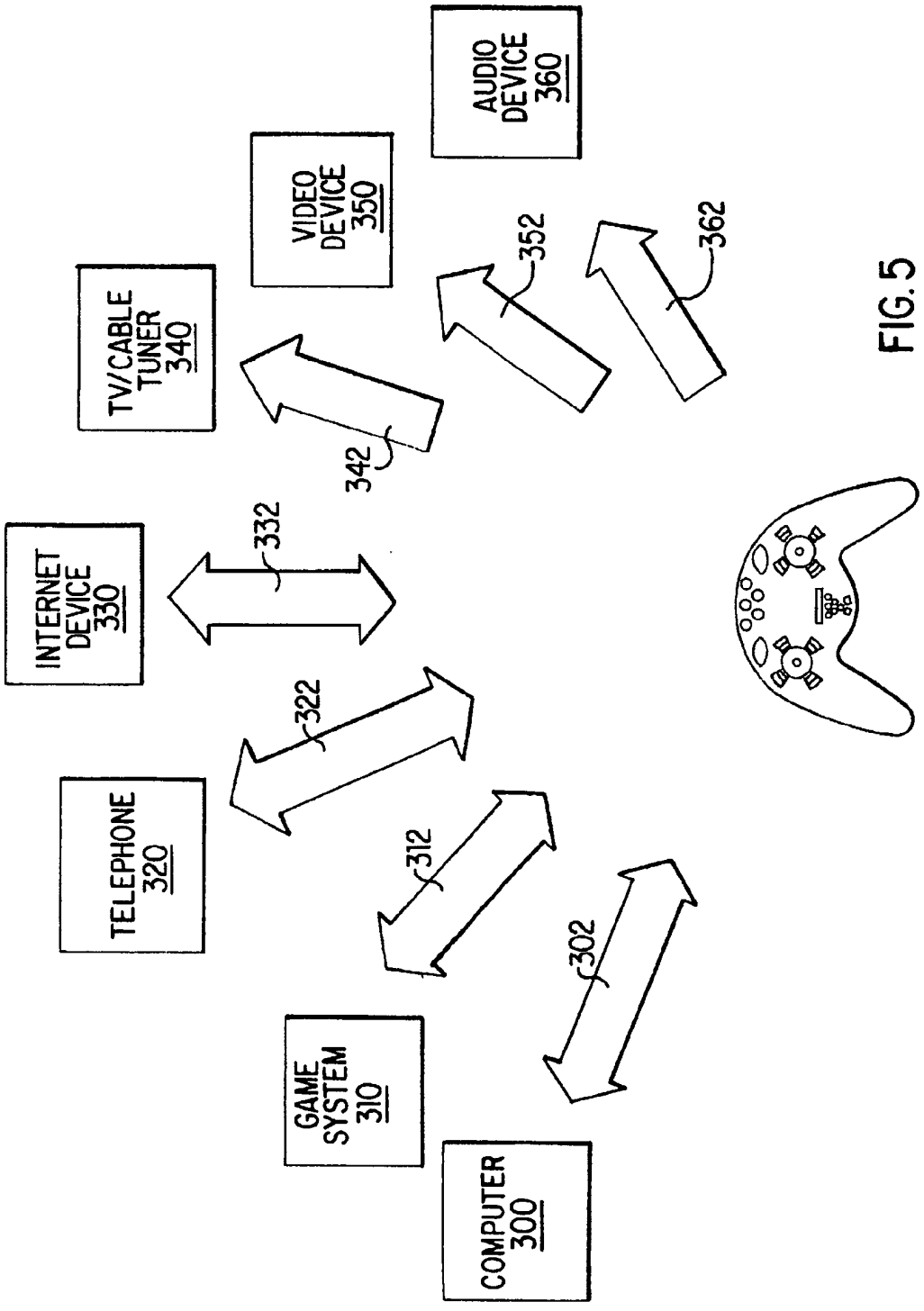
AUDIO DEVICE 360
VIDEO DEVICE 350
TV/CABLE TUNER 340
INTERNET DEVICE 330
TELEPHONE 320
GAME SYSTEM 310
COMPUTER 300
362
352
342
332
322
312
302

FIG. 5

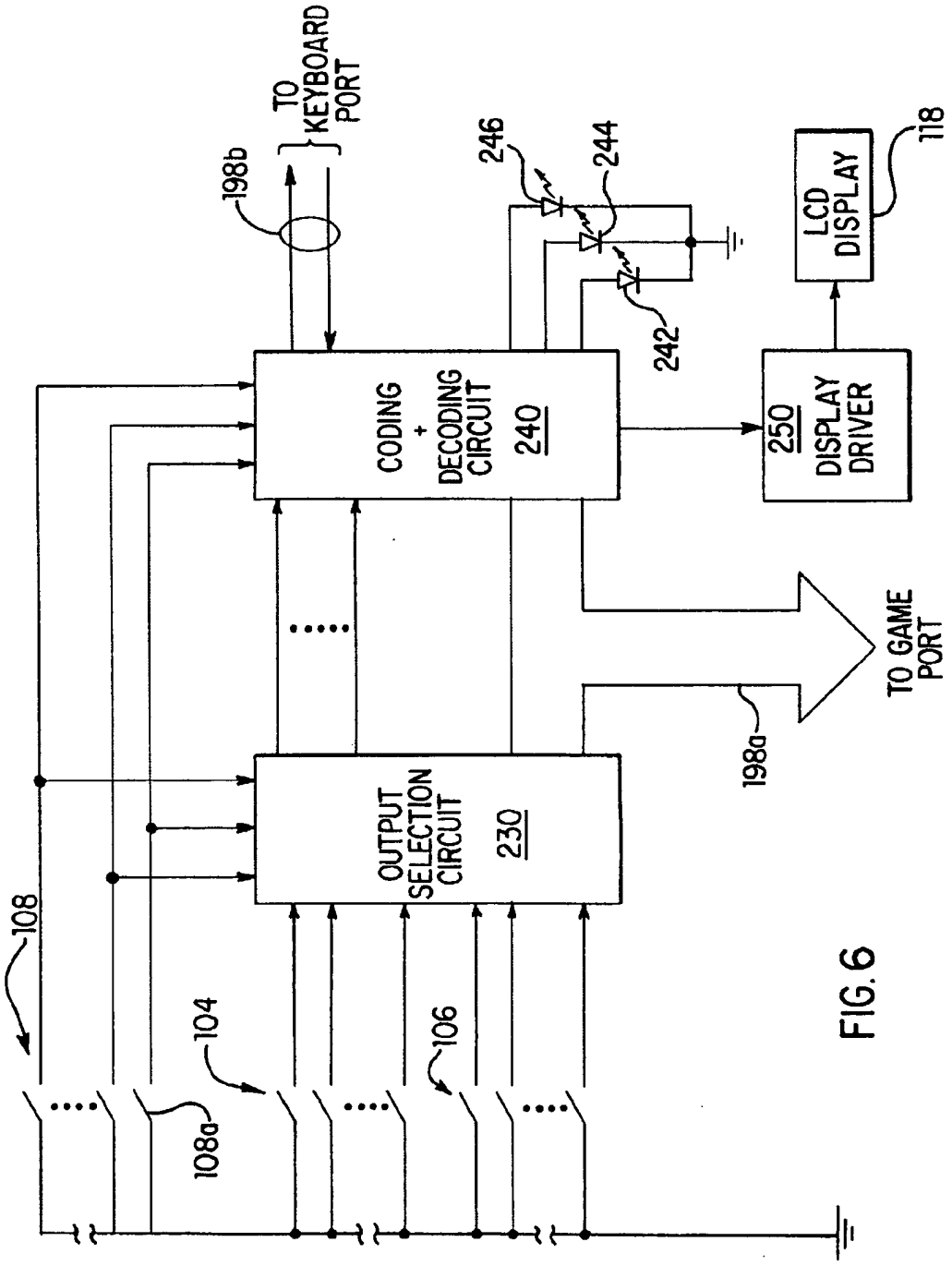
TO KEYBOARD PORT
198b
246
244
242
LCD DISPLAY
118
CODING + DECODING CIRCUIT 240
250 DISPLAY DRIVER
TO GAME PORT
198a
OUTPUT SELECTION CIRCUIT 230
108
104
106
108a

FIG. 6

DATA ENTRY SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

This invention directs itself to ergonomic keyboard systems for providing data entry to one or more devices. In particular, this invention directs itself to a data entry system which can function as a game controller and as an ergonomic keyboard. Still further, this invention directs itself to a data entry system having an ergonomic base with a central support portion supporting a plurality of upper surface controls. The ergonomic base further includes a back side having a plurality of side surface controls. More in particular, this invention pertains to a data entry system wherein upper surface controls and side surface controls can be used independently, or in combination to provide alphanumeric and keyboard control signals in a keyboard mode, while also functioning independently in a device mode.

Prior Art

Keyboard data entry systems and game controllers are well known in the art. The best prior art known to the Applicants include U.S. Pat. Nos. 5,493,654; 5,486,058; 5,481,263; 5,479,163; 5,451,053; 5,432,510; 5,426,449; 5,408,621; 5,332,322; 5,317,505; 5,207,426; 5,160,919; 5,137,384; 4,917,516; 4,655,621; 4,552,360; 4,833,446; 4,727,478; 4,680,577; 4,518,164; 4,516,939; 4,443,789; 4,442,506; 4,360,892; 3,990,565; German Patent No. 30804; PCT Publication No. WO86-05143; European Published Patent Application No. EP213022; the publication entitled "Semi-captive Keyboard", *Xerox Disclosure Journal*, Vol. 1, No. 2, February 1976; and, the publication entitled "Hand-held Data Input Device", *IBM Technical Disclosure Bulletin*, Vol. 26, No. 11, April 1984.

Some prior art systems, such as that shown in U.S. Pat. Nos. 3,990,565; 5,137,384; 5,160,919; and, 5,426,449 are directed to ergonomic keyboard systems wherein the user's hands are substantially vertically oriented when the keyboard is used. Such systems disclose utilizing somewhat standard QWERTY keyboard formats, as opposed to chord type systems. However, such systems do not disclose or suggest the combination of a keyboard with a game controller.

In other prior art systems, such as that disclosed in U.S. Pat. No. 5,408,621, there are provided multi-directional switches for use in entering data into a computer. Through utilization of two twelve position directional type switches, one hundred and forty-four different input combinations are generated to provide input of alphanumeric and other symbols. However, such does not disclose the combination of a keyboard data entry system and a game controller and does not provide for data entry utilizing both the thumbs and fingers of both hands of the user, to provide for high speed data entry.

In still other systems, such as that disclosed by U.S. Pat. Nos. 4,552,360 and 4,518,164, video game controllers are disclosed which include a numeric keypad. While the keypad provides for limited data entry, such is intended to allow input of information to the video game computer during play, to select skill levels, initiate the game, or the like. Such systems do not include any mode controls for utilization of the multi- directional switches for generation of alphanumeric characters in a keyboard mode.

Over the years, many prior art systems have presented alternatives to the QWERTY format as a means of increasing typing speed. While those systems would permit a user to type faster, they required a user to learn the new keyboard layout. In spite of the potential typing speed increase, the public has been loath to adopt any keyboard format other than the old QWERTY arrangement. It is clear that once typists become familiar with a keyboard layout, a promised increase in typing speed is not sufficient motivation to learn an additional keyboard arrangement.

During the past decade there has been a tremendous growth in the use and ownership of computer and video games. As a result, children and young adults have become very accustomed to handling and using game controllers that incorporate multidirectional switches. This growing portion of the keyboard-using population is likely to adopt a keyboard format that is arranged like a game controller, can function as a game controller, is ergonomically designed, allows users to enter data while seated in a reclined position away from a desk and offers greater typing speed. The likelihood of the instant invention being adopted by a large segment of the keyboard-using public is further enhanced by the fact that the instant invention requires a minimal number of simultaneous depression of keys.

SUMMARY OF THE INVENTION

A data entry system is provided. The data entry system includes an ergonomic housing adapted to be held by two hands of a user. The data entry system also includes a plurality of switches mounted on the housing for operation by at least one digit of the user's hands, and a switching assembly mounted on the housing for selecting between a first operating mode and a second operating mode. The data entry system further includes a circuit for coupling an output of at least a portion of the plurality of switches as game input data responsive to the switching assembly selecting the first operating mode and converting an output of at least a portion of the plurality of switches to alphanumeric character code data responsive to the switching assembly selecting the second operating mode.

Looking at the data entry system in another way, such includes an ergonomic base adapted to be graspable by two hands of a user, the ergonomic base having an upper surface and a side surface. Additionally, the data entry system includes upper surface controls disposed on the ergonomic base upper surface and adapted for operation by either of two of a user's digits to generate a first set of electrical signals. Further, side surface controls are provided that are disposed on the side surface of the ergonomic base and adapted for operation by at least another of a user's digits on either of the user's two hands to generate a second set of electrical signals when operated independently and a third set of electrical signals when operated in combination with the upper surface controls. The first and second sets of electrical signals together representing at least a majority of alphabetic characters of an alphabet.

It is therefore a feature of the invention to provide a data entry system which combines the functionality of an ergonomic keyboard with that of a game controller.

It is another feature of the invention to provide a data entry system having an ergonomic base which includes a pair of hand grip portions which extend substantially orthogonally with respect to an upper surface thereof.

It is a further feature of the invention to provide a data entry system having both upper surface controls and side surface controls which respectively generate first and second sets of electrical signals, the first and second sets of electrical signals representing a majority of alphabetic characters of an alphabet.

It is still a further feature of the invention to provide upper surface controls and side surface controls which respectively generate first and second sets of electrical signals when operated independently, and generate a third set of electrical signals when operated in combination, the third set of electrical signals representing characters selected from the group consisting of numbers, punctuation, mathematical operators, words and combinations thereof.

It is yet a further feature of the invention to provide a data entry system having upper surface controls which generate signals representing alphabetic characters in a keyboard mode and directional control signals in a game controller mode.

Yet another feature of the invention is to provide a data entry system capable of generating alphabetic characters in a keyboard mode and control signals for controlling such devices as telephones, dedicated Internet interface devices, and home entertainment devices in one or more device control modes.

These and other advantages and novel features of the invention will become apparent from the following detailed description when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view of the data entry system according to the present invention;

FIG. **2** is a rear elevation view of the present invention;

FIG. **2A** is a rear elevation view of another configuration of the present invention;

FIG. **3** is a cut-away plan view of an alternate configuration of a directional control of the present invention;

FIG. **4** is a plan view of the present invention showing the addition of labeling thereto;

FIG. **5** is a block diagram illustrating the multi-mode functions of the present invention; and,

FIG. **6** is a circuit block diagram of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. **1**, **2** and **4–6**, there is shown data entry system **100** which combines an ergonomic keyboard with a device controller. As will be seen in following paragraphs, data entry system **100** is specifically directed to the concept of providing a single data entry device capable of communicating with a host of computational, communication and entertainment devices, found in the workplace and in the home. Data entry system **100** functions as a fully functional **101** key keyboard for communication with a computer system **300** and dedicated Internet device **330** or any other device that utilizes an alphanumeric input, while acting as a numeric entry handset for telephone system **320**. When used with telephone system **320**, a microphone **184** incorporated in system **100** is used to input voice signals, while a speaker of telephone system **320** or incorporated in system **100** (not shown) provides the voice output to the user. Data entry system **100** also is capable of functioning as a game controller for use with the dedicated game system **310**, or the personal computer **300**, and as a remote control device for such entertainment devices as the TV or cable tuner **340**, a video entertainment device **350** or an audio entertainment device **360**. Thus, a single ergonomically designed base **102** provides the controls **104**, **106**, **108**, **152** for interfacing with any one or more of the computational, communications and entertainment devices available for use in the home or office.

Referring now to FIG. **1**, data entry system **100** is packaged within an ergonomic base **102** having a centrally disposed supporting portion **115** from which hand grip portions **114** and **116** angularly extend. Thus, data entry system **100** is intended to be utilized by both hands of a user. The user grasps the respective hand grip portions **114**, **116** with each hand, the user's thumbs remaining extended over the central supporting portion. Both the central supporting portion **115** and each of the hand grip portions **114** and **116** include switches which the user will utilize to enter data and control signals. Those switches which are disposed on the central support portion **115** define the upper surface controls **104**, such controls being intended to be individually operated by one or both thumbs of the user. The central support portion **115** also is provided with a display **118**, which may include an LCD display for indicating the particular operating mode of system **100**, as well as include light emitting diode (LED) indicators for indicating the enablement of the number, shift and scroll lock functions.

The primary data entry controls of upper surface controls **104** are a pair of multi-directional switch assemblies **110** and **112**, commonly known as D-pads. D-pads are well known in the game controller art, and function to provide particular contact closures depending upon where the user applies pressure on an operating button thereof. When the user depresses the uppermost or northern position **130**, **158** of the D-pad **110**, **112**, such is equivalent to depressing a key of a standard keyboard. When the user depresses the rightmost or east portion of the D-pad **132**, **160**, such is equivalent to a different key of a standard keyboard being depressed. Likewise, separate keystroke entries are made by depressing the southern portion **134**, **162** and western portion **136**, **164**. It is possible to provide for yet additional keystroke entries by depression of the D-pad in portions intermediate the north, east, south and west positions without departing from the scope of the present invention. A switch pushbutton **150**, **166**, defining an additional keystroke entry position, may be provided centrally on each D-pad **110**, **112**. Thus, each D-pad **110**, **112** may provide for five keystroke entries, that then may be increased utilizing chording techniques, as will be described in following paragraphs. Where switch pushbutton **150**, **166** is not provided, the characters which would otherwise be generated thereby are generated by other of the upper surface control switches **104** or side surface control switches **106**.

Alternately, as shown in FIG. **3**, the D-pads may be replaced by four to five discrete switches. As an example, the upper surface controls **104'** may include a switch pushbutton **158'** disposed in the north position, a switch pushbutton **160'** located in the east position, a switch pushbutton **162'** located in the south position, and a switch pushbutton **164'** located in the west position. Optionally, a switch pushbutton **166'** may be centrally disposed with respect to switch pushbuttons **158'**, **160'**, **162'** and **164'**. Each of the switches being located on the central supporting portion **115** of the ergonomic base **102** are intended to be operated by the thumb of the user. Although the switch pushbuttons **158'**, **160'**, **162'**, **164'**, and **166'** are shown on the right side of ergonomic base **102**, it should be understood that the D-pad **110** may also be replaced by a similar arrangement of switch pushbuttons.

Referring back to FIG. **1**, each of the D-pads **110**, **112** are surrounded by additional switch pushbuttons for additional keystroke entries utilizing the user's thumbs. Thus, surrounding the D-pad **110** there is provided a first pair of switch pushbuttons **138** and **140** that are radially spaced and disposed intermediate the north D-pad position **130** and east D-pad position **132**. Between the east position **132** and the

south position **134**, there are provided a pair of radially spaced switch pushbuttons **142** and **144**, and between the south position **134** and the west position **136** there is also provided a pair of radially spaced switch pushbuttons **146** and **148**. Further, between the west position **136** and the north position **130** there is provided a pair of radially spaced switch pushbuttons **126** and **128**. Similarly, the D-pad **112** is surrounded by radially spaced pairs of switch pushbuttons. Between the north position **158** and east position **160** there is provided a pair of radially spaced switch pushbuttons **168** and **170** and between the east position **160** and south position **162** there is a pair of radially spaced switch pushbuttons **174** and **172**. A pair of switch pushbuttons **178** and **160** are disposed radially between the south position **162** and the west position **164**, and radially spaced between the west position **164** and north position **158** there is provided a pair of switch pushbuttons **182** and **180**. While the switch pushbuttons **126, 128, 138, 140, 142, 144, 146, 148** and **168, 170, 172, 174, 176, 178, 180, 182** have been disclosed as being radially positioned with respect to the D-pads **110, 112**, such may be arranged in side-by-side relationship in angularly spaced relationship with respect to the D-pad **110, 112**. Further, one or more of such switch pushbuttons may be associated with multi-position switches, and in particular, may be associated with two-position switches wherein one keystroke is accomplished by depressing one end of the switch and a separate keystroke is enabled by depression of the opposing end, as in a rocker type switch.

The upper surface controls **104** may also include a pair of multi-directional switches **154** and **156**. Multi-directional switch **154** may be a cursor displacement control switch for inputting one of four directional inputs for use by a computer as an input for moving the cursor on a display screen. Multi-directional switch **156** may be utilized as a page/file displacement control switch to provide the PAGE UP, PAGE DOWN, HOME and END functions when system **100** is in a keyboard mode. Those switches may serve other functions when system **100** is in other than a keyboard mode. A plurality of single or multiple position switches may be provided to serve as function switches **152**, providing the function switch input commonly found on conventional personal computer keyboards.

Referring now to FIG. **2**, a rear view of the ergonomic base **102** of data entry system **100** is shown in order to depict the side surface controls **106**. The hand grip portions **114** and **116** extend substantially orthogonally with respect to the upper surface of the ergonomic base allowing the user's hands to be disposed in a more natural vertical orientation. As each of the user's hands are wrapped around the respective handgrip portions **114** and **116**, the user's digits are able to operate the side surface control switches **106** located on the back side **105** of ergonomic base **102**. In the embodiment shown, each of the user's forefingers is intended to operate a selected one of two switch pushbuttons **192** and **194, 186** and **188**. Each of the switch pushbuttons **192, 194, 186** and **188** are associated with two-position switches providing one keystroke when the user depresses a first end of the switch pushbutton **192*a*, 194*a*, 186*a*, 188*a*** and another keystroke when the user depresses the opposing second end of the switch pushbutton **192*b*, 194*b*, 186*b*, 188*b***. Below the forefinger operated switch pushbuttons there is provided an additional two-position switch associated with switch pushbuttons **196, 190** for operation by a respective one of the user's middle fingers, with the remaining digits of the user being utilized to grasp the handgrip portions **114** and **116** and maintain the stability of data entry system **100**.

The back side **105** of ergonomic base **102** is also provided with an optical communications port **200** for providing a wireless interface with one or more systems, as will be further described in following paragraphs. Port **200** consists of an infrared transparent window behind which is disposed one or more photo sensors and infrared emitting devices (not shown). For providing a hard wire interface, system **100** includes an interface cable **198**. Interface cable **198** has connectors for coupling to a computer's keyboard port and the computer's game port or the controller port of a dedicated game system on an opposing end thereof (not shown). As an alternate to connecting to the personal computer's game port, the interface connection with the personal computer may be by way of the computer's serial or parallel ports, in addition to the keyboard port interface, or the interface cable may provide coupling to an interface bus of the computer.

In the keyboard mode, initiated by use of one of the mode selection controls **108**, such as the switch **108*a***, shown in FIG. **1**, character codes are transmitted from data system **100** by independent operation of any of the upper surface controls **104** and side surface controls **106**. By use of the D-pads **110** and **112**, and the plurality of two-position side surface controls **106**, the character codes for at least a majority of the alphabetic characters of an alphabet can be generated by single individual switch operations, without resorting to chording. Where a combinational key activation (chording) is to be utilized, system **100** utilizes a cross-coupling technique, wherein a switch closure activated by a user's left thumb is combined with the operation of one of the side surface controls **192, 194** or **196**. Conversely, when a switch closure activated by the user's right thumb is to be part of a combinational key activation, such is combined with operation of one of the switches **186, 188** or **190** operated by the digits of the user's left hand.

An exemplary representation of the character codes generated by individual and combinational switch activations is shown in Table 1.

TABLE 1

SW		186a	146b	188a	188b	190a	190b	192a	192b	194a	194b	196a	196b
130	c							2	1	4	3	6	5
132	d							'	"	;	:	!	?
134	h							to	the	of	and	in	for
136	b							|	—	>	}	<	{
150	·												
158	p	7	8	9	0	+	−						
160	r	/	*	\	#	@	&						
162	w	$	%	^	with	that	was						
164	n	)	]	{	[	~	`						
166	,												

TABLE 1-continued

SW		186a	145b	188a	188b	190a	190b	192a	192b	194a	194b	196a	196b
186a	space												
186b	a												
188a	l												
188b	e												
190a	m												
190b	l												
192a	space												
192b	0												
194a	s												
194b	u												
196a	t												
196b	y												
138	shift												
140	enter												
142	f							Esc.	Esc.				
144	j							TAB	TAB				
146	g												
148	k												
126	Alt												
128	Ctl												
168	Alt												
170	Ctl												
172	v												
174	z												
176	q	Back Spc.	Back Spc.										
178	x	DEL	INS										
180	shift												
182	enter												

As shown in Table 1, all of the alphabetic characters in the English language are generated by individual switch closures, a portion thereof being generated by the upper surface controls **104** and a remaining portion being generated by the side surface controls **106**.

When the mode is changed from the keyboard mode to the game controller mode, such as by activating switch **108***a* for a second time, the upper surface controls **104** and side surface controls **106** provide device input signals that are output to a computer's game port or to the controller input port of a dedicated game system. Thus, one or both of the D-pads **110**, **112** provide directional input for use by game software and one or more of the side surface controls **186**, **188**, **190**, **192**, **194**, **196** provide switch closure signals which are typically utilized by game software to control the firing of weapons, and provide control of particular maneuvers of the game icons, such as jumping, flying, and the like.

When in a mode to control some other device, such as a telephone, dedicated Internet connection device, a TV/cable tuner, video entertainment device, or an audio entertainment device, the upper surface controls **104** and side surface controls **106** are utilized to provide the necessary signals to control the device, answer or dial a telephone, move a cursor, change the channel of a tuner, initiate the playing of a video tape or disc, or to change the volume or station on a stereo, for example. The particular switches of upper surface controls **104** and side surface controls **106** which are utilized to perform those functions, are not important to the inventive concepts embodied herein, and it is contemplated that such assignments may be programmable by the users to suit their own tastes.

Due to the large number of control functions which are possible utilizing upper surface controls **104** and side surface controls **106**, the control of several devices may be combined in a single mode. Thus, a home entertainment mode could include operation of a TV cable tuner **340**, one or more video devices **350** and one or more audio devices **360**, utilizing the separate D-pads **110** and **112** and the switch pushbuttons **186**, **188**, **190**, **192**, **194** and **196**. In such an arrangement, data entry system **100** would be interfaced with a personal computer **300** utilizing the interface cable **198** for communicating with the computer in both the keyboard mode and the game controller device mode. In the home entertainment device mode, data entry system **100** could communicate with the various devices to be controlled utilizing the optical communications port **200**.

Therefore, it can be seen that data entry system **100** is very versatile and may be utilized to interface with a plurality of entertainment, computational and communications devices, as illustrated in FIG. **5**. Data entry system **100** is intended to communicate with a computer **300**, which may be a personal computer, wherein a data link **302** may be established utilizing the interface cable **198** or optical communications port **200**. When coupled to computer **300**, data entry system **100** may be utilized in a keyboard mode wherein the single and combinational switch closures provided through operation of the upper surface controls **104** and side surface controls **106** establish signals which are output to the computer to represent alphanumeric characters, punctuation, mathematical operators, and commonly used words such as "the", "to", "and", "of", "for", "in", "with", "that", and "was", for example. When the computer is utilized for playing games, data entry system **100** is switched into a game controller mode, wherein the same switch closures which previously generated a character code input to the keyboard port of the computer, now are input to the game port as input signals representing directional and operational control signals.

Data entry system **100** may be coupled directly to a dedicated game system **310**, such as the type manufactured by Nintendo, Sega, Sony and others for communication over a data link **312**. If the dedicated game system **310** accepts alphanumeric character input codes, data entry system **100** may be utilized in a mode to provide such input. Whether

coupled to computer **300** or dedicated game system **310**, data entry system **100** may be placed in other device modes for communicating with other systems, such as the telephone system **320** through the data channel **322**. When coupled to telephone system **320**, the user provides voice input through a microphone **184**, and receives voice output by means of a speaker (not shown) located in the telephone system **320** or data entry system **100**. Preferably, the communications over the data link **322** would be a wireless communications link such as by use of the optical communications port **200**, but may be by way of a radio frequency communications port disposed within ergonomic base **102**. Similarly, data entry system **100** may be utilized for interface with a dedicated Internet device **330** through a data link **332**, to provide the appropriate keyboard character codes and cursor positioning input to the Internet device **330**. As previously mentioned, data entry system **100**, acting as an infrared remote control, may be utilized to control such home entertainment devices as the TV/cable tuner **340** through data link **342**, video device **350** (which may be a video tape recorder, video disc player, or the like) through the data link **352**, and the audio entertainment device **360** (which may be a stereo tuner, audio tape deck, CD player, or the like) through the data link **362**. The particular data links **302, 312, 322, 332, 342, 352, 362** represent a hardwired or wireless communications path for unidirectional or bidirectional transmission of data, utilizing the appropriate coding for the particular device being communicated with.

Referring now to FIG. **6**, there is shown a block diagram of the circuit arrangement for coupling the switch closures of the upper surface controls **104** and side surface controls **106** to the appropriate port. As the coding circuitry for converting individual switch closures into the digital character codes utilized by most computers are well known, such are not detailed here. The coding and decoding circuit block **240** includes the well known circuitry for converting switch closures to character codes and for decoding any control signals which may be supplied from the computer to the keyboard. The coding and decoding circuitry **240** is controlled by input from the mode selection switches **108**, allowing different coding schemes to be utilized, depending upon the mode selected, and coupling such to either the keyboard port, through a respective portion **198*b*** of the interface cable **198** or to the game, serial, or parallel port through portion **198*a*** of the interface cable **198**, as required by the computer being communicated with. An output of the coding and decoding circuitry **240** is also coupled to display driver circuitry **250**, which in turn provides an output to the LCD display **118** for indicating the mode of system **100**. Other information transmitted between the computer and system **100** may also be displayed on LCD display **118**. Coding and decoding circuitry **240** also provides an output to several light emitting diodes (LEDs) to indicate the status of certain keyboard functions. In particular, the LED **242** may represent the NUM LOCK indicator, the LED **244** may represent the CAP LOCK indicator and the LED **246** may represent the SCROLL LOCK indicator.

In the keyboard mode, the individual contact closures of the upper surface controls **104** and side surface controls **106** are coupled to the coding and decoding circuitry **240** by means of an output selection circuit **230**. Output selection circuit **230** provides a switching function responsive to the mode of operation selected through the mode selection controls **108**. Thus, in the keyboard mode the switch closures from the upper surface controls **104** and side surface controls **106** are passed to the coding and decoding circuitry **240**. In the game controller mode, however, the switch closures of the upper surface controls **104** and side surface controls **106** are coupled directly to the game port through the portion **198*a*** of the interface cable **198**. Alternately, the cable portions **198*a*** and **198*b*** may be replaced with a connection to the optical communications port **200** for providing a wireless coupling with the computer, and/or other device.

Data entry system **100'** represents an alternate configuration wherein the back side **105'** of the ergonomic base **102'** provides two directional switches to be operated by the digits of each of the user's hands, as shown in FIG. **2A**. In this arrangement, the user's forefingers selectively operate the switch pushbuttons **186, 192** and **188, 194** and the middle finger is utilized to activate the switch pushbuttons **190** and **196**, as in the previously described arrangement. The side surface controls **106'**, however, include two pairs of additional switch pushbuttons for operation by additional digits of the user's hands. The user's ring fingers are used to operate the switch pushbuttons **185** and **193**, respectively, while the user's pinky fingers operate the switch pushbuttons **187** and **195**. As each of the side surface control switches **106'** can provide one of two contact closures, depending upon the direction in which they are pushed, such provide a total of ten different contact closures initiated by four of the digits of each of the user's hands, providing a total of twenty contact closures for use individually to generate characters, or in combination with the upper surface controls **104**, as previously described. For ease of use, only the side surface control switch pushbuttons **186, 188, 190, 192, 194,** and **196** are utilized in combination with the upper surface control switches **104**. Assignment of switch functions for the upper surface control switches **104**, side surface control switches **106'** and the combination thereof is shown in Tables 2 and 3. Table 2 identifies the characters generated utilizing the user's left thumb and right fingers, and Table 3 illustrates the characters generated using the user's right thumb and left fingers.

TABLE 2

Sw.		192a	192b	194a	194b	196a	196b
130	1	2	1	4	3	6	5
132	b	'	"	;	:	!	?
134	x	to	the	of	and	in	for
136	j	>	}	<	{	|	_
150	·						
126	ALT						
128	CTL						
138	SHIFT						
140	ENTER						
142	ESC.						
144	TAB						
146	–						
148	+						
192a	,						
192b	o						
194a	k						
194b	w						
196a	s						
196b	a						
193a	n						
193b	u						
195a	g						
195b	h						

TABLE 3

Sw.		186a	186b	188a	188b	190a	190b
158	c	7	8	9	0	+	-
160	p	/	*	\	#	@	&
162	q	$	%	^	was	that	with
164	z	)	]	(	]	"	'
166	,						
168	ALT						
170	CTL						
172	ESC.						
174	BK SP						
176	DEL						
178	INS						
180	SHIFT						
182	ENTER						
186a	·						
186b	e						
188a	v						
188b	m						
190a	r						
190b	I						
185a	t						
185b	y						
187a	f						
187b	d						

As data entry system **100'** utilizes all of the user's digits for data entry, it may be difficult for the user to both support the ergonomic base **102** while operating the upper surface control switches **104** and side surface control switches **106'** and such could also be true for system **100**. To provide additional support for data entry system **100, 100'** the ergonomic base **102, 102'** may employ strategically located indentations (not shown) or finger loop supports **120** coupled to the respective hand grip portions **114** and **116** of the ergonomic base **102, 102'**. Although the finger loop supports are only shown in conjunction with the configuration shown in FIG. **2A**, such is applicable for use with the configuration shown in FIG. **2**. Each finger loop support **120** includes a pair of support rings **122**, each having an aperture **124** through which the user's respective fingers pass. By use of the finger loop supports **120** the ergonomic base **102, 102'** can be supported during periods of time when the user's grip is lessened due to utilization of the user's digits to depress respective switches of the side surface controls **106, 106'**.

To make use of data entry system **100, 100'** easier to use, indicia carrying labels **202, 204, 206, 208, 210, 212, 214, 216, 217** and **223** are provided, as shown in FIG. **4**. Label **217** includes respective finger switch label portions **218, 220** and **222** which represent the switch pushbuttons **186, 188** and **190** disposed on the back side **105** of ergonomic base **102**. Each of the labeled portions **218, 220** and **222** carry indicia indicating the particular character generated when the switch is operated. Additionally, each is color coded to aid the user in identifying the characters generated when the respective switches **186, 188** and **190** are utilized in combination with the D-pad **112**. Angularly disposed about the D-pad **112** are thumb switch labels **210, 212, 214** and **216**. Each of the labels is located adjacent a respective switch position (north, east, south, west) and carrying indicia indicating the particular characters generated when that particular switch position is operated in combination with one of the switches **186, 188**, or **190**. The representation of characters generated when the particular positions of the D-pad **112** are operated independently, are embossed, or otherwise printed, on the D-pad disc itself. Each of the labels **210, 212, 214** and **216** are divided into two columns with three radially spaced rows to define six blocks, each block defined thereby being color coded in coordination with the label portions **218, 220** and **222** of label **217**, thereby cuing the user as to what character is generated by the switch combination, by virtue of the matching colors. Similarly, the hand grip **116** carries a label **223** with finger switch label portions **224, 226** and **228**. Although the label portions **224, 226** and **228** are shown to carry the same color codes as those of label portions **218, 220, 222**, such may be coded utilizing different colors. As in the case of D-pad **112**, D-pad **110** is also surrounded by thumb switch labels **202, 204, 206** and **208**, each subdivided and color coded, as previously described.

Therefore, it can be seen that data entry system **100, 100'** provides an ergonomic housing adapted to be held by two hands of a user. Mounted on the housing are a plurality of switches for operation by at least one digit of the user's hands. Further, means are provided on the housing for selecting between a first, game controller, operating mode and a second, keyboard, operating mode. Within the housing there is provided circuitry for coupling an output of at least a portion of the plurality of switches as game input data responsive to the selection of the first operating mode and converting an output of at least a portion of the plurality of switches to alphanumeric character code data responsive to selection of the second operating mode. By utilization of directional switch pads, commonly utilized in game controllers for input of alphanumeric characters in the keyboard mode, and utilization of a plurality of side surface control switches, a majority of alphabetic characters of an alphabet can be generated without resorting to a chording arrangement wherein multiple switches must be utilized in combination. For the English language, all of the alphabetic characters can be generated without resorting to chording. Still further, other device controlling modes may be incorporated into data entry system **100**, those modes providing control signals for controlling one or more of the devices selected from the group consisting of a video entertainment device, audio entertainment device, cable/television tuning device, telephonic device, Internet interface device, game machine, and combinations thereof.

Although the invention has been described in connection with specific forms and embodiments thereof, it will be appreciated that various modifications other than those discussed above may be resorted to without departing from the spirit or scope of the invention. For example, equivalent elements may be substituted for those specifically shown and described, certain features may be used independently of other features, and in certain cases, particular locations of elements may be reversed or interposed, all without departing from the spirit or scope of the invention as defined in the appended Claims.

What is claimed is:

1. A data entry system combining an ergonomic keyboard and a device controller, comprising:

an ergonomic base adapted to be graspable by two hands of a user, said ergonomic base having an upper surface and a side surface;

upper surface control means disposed on said ergonomic base upper surface and adapted for operation by either of two of a user's digits to generate a first set of electrical signals;

side surface control means disposed on said ergonomic base side surface and adapted for operation by at least another of a user's digits on either of the user's two hands to generate a second set of electrical signals when operated independently and a third set of electrical signals when operated in combination with said upper surface control means; and,

mode select means disposed on said ergonomic base for establishing said first, second and third sets of electrical signals as (a) respective sets of device input signals, or (b) respective sets of alphanumeric and keyboard control signals responsive to a user's selection of one of (1) a device mode, and (2) a keyboard mode.

2. The data entry system as recited in claim 1 where said upper surface control means includes at least one multi-position input device for providing at least four discrete output signals responsive to said multi-position input device being displaced in each of four discrete directions.

3. The data entry system as recited in claim 1 where said ergonomic base includes a pair of hand grip portions extending angularly with respect to said upper surface, each of said hand grip portions being adapted to be gripped by the user's fingers, said side surface control means being disposed on said pair of hand grip portions.

4. The data entry system as recited in claim 3 where each of said pair of hand grip portions extend substantially orthogonally with respect to said upper surface.

5. The data entry system as recited in claim 1 where said first and second sets of electrical signals together represent a majority of alphabetic characters of an alphabet in said keyboard mode.

6. The data entry system as recited in claim 5 where said third set of electrical signals represent characters selected from the group consisting of numbers, punctuation, mathematical operators, words and combinations thereof, in said keyboard mode.

7. The data entry system as recited in claim 1 where at least a portion of said first set of electrical signals represent directional control signals in said device mode.

8. The data entry system as recited in claim 1 where at least a portion of said first set of electrical signals represent control signals for a device selected from the group consisting of a video entertainment device, audio entertainment device, television cable tuning device, telephonic device, Internet interface device, game machine, and combinations thereof, in said device mode.

9. The data entry system as recited in claim 1 where said third set of electrical signals are generated by combining operation of said upper surface control means by one of a user's hands with operation of said side surface control means by the other of a user's hands.

10. The data entry system as recited in claim 1 where said upper surface control means includes at least four switch pushbuttons grouped together on said ergonomic base upper surface.

11. The data entry system as recited in claim 3 where each of said hand grip portions includes support means for assisting in support of said ergonomic base while said side surface control means is being operated.

12. A data entry system, comprising:

an ergonomic base adapted to be graspable by two hands of a user, said ergonomic base having an upper surface and a side surface;

upper surface control means disposed on said ergonomic base upper surface and adapted for operation by either of two of a user's digits to generate a first set of electrical signals;

side surface control means disposed on said ergonomic base side surface and adapted for operation by at least another of a user's digits on either of the user's two hands to generate a second set of electrical signals when operated independently and,

mode select means disposed on said ergonomic base for establishing said first and second sets of electrical signals as (a) respective sets of device input signals, or (b) respective sets of alphanumeric and keyboard control signals responsive to a user's selection of one of (1) a device mode, and (2) a keyboard mode.

13. The data entry system as recited in claim 12 where at least a portion of said first set of electrical signals represent directional control signals in said device mode.

14. The data entry system as recited in claim 13 where at least a portion of said first set of electrical signals represent control signals for a device selected from the group consisting of a video entertainment device, audio entertainment device, television cable tuning device, telephonic device, Internet interface device, game machine, and combinations thereof, in said device mode.

15. A data entry system comprising:

an ergonomic housing adapted to be held by two hands of a user;

a plurality of switches mounted on said housing for operation by at least one digit of the user's hands;

switching means mounted on said housing for selecting between a first operating mode and a second operating mode; and,

circuit means for coupling an output of at least a portion of said plurality of switches as game input data responsive to said switching means selecting said first operating mode and converting an output of at least a portion of said plurality of switches to alphanumeric character code data responsive to said switching means selecting said second operating mode.

* * * * *

APPENDIX C

CASES CITED IN APPELLANT'S BRIEF

In re Grasselli, 713 F.2d 731, 218 USPQ 769 (Fed. Cir. 1983).

In re Lee, 61 USPQ 2d. 1430 (Fed. Cir. 2002).

In re Dembiczak, 175 F.3d 994, 50 USPQ2d 1614 (Fed. Cir. 1999).

In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).